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Novel Limestone Quarry Operation

New Crushing Plant of Olympic Portland Cement Co.

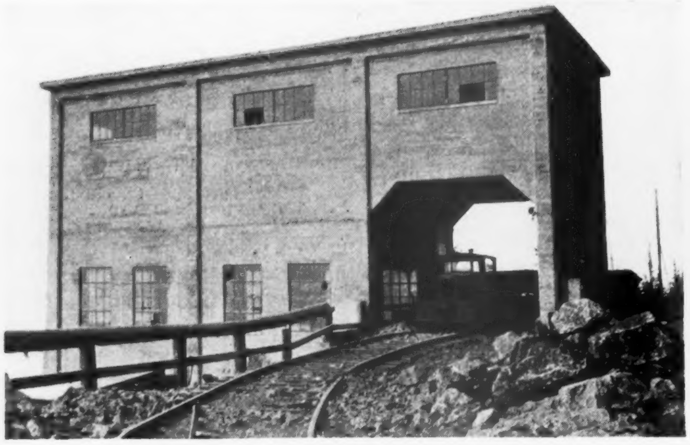
THIRTY miles from Bellingham, Wash., and in the heart of one of the most beautiful mountain regions for which the Pacific northwest is famous, is the small town of Limestone, principally noted as the location of the new and large crushing plant of the Olympic Portland Cement Co. The quarry site is about eight miles from Sumas, Wash., which is just on the American side, Huntingdon, B. C., adjoining.

This section is one of the fast diminishing parts of the United States which offer the outdoor lover and sportsman some real scenic beauty and recreation. There is an abundance of game such as deer and bear; for the fisherman, there are the deep sea and mountain trout, to say nothing of the wide variety of other fish. All this in close proximity to one of the modern crushing plants in this country.

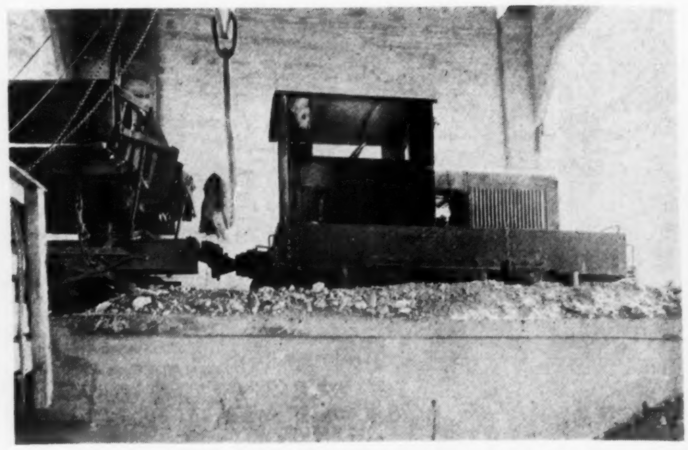
Jack Krabbe, son of the general manager, starting a round

Loading terminal as seen from head house

At one time Limestone and adjacent country was the center of a huge logging industry. The convenient location with respect to railway and highway facilities led the earlier logging operators of the district to attack the forests there first, stripping them of their best timber. Now the logging operations have pushed to more inland and less easily accessible places. Small timber still remains in vast forests so dense that passing through



Exterior of primary crusher building

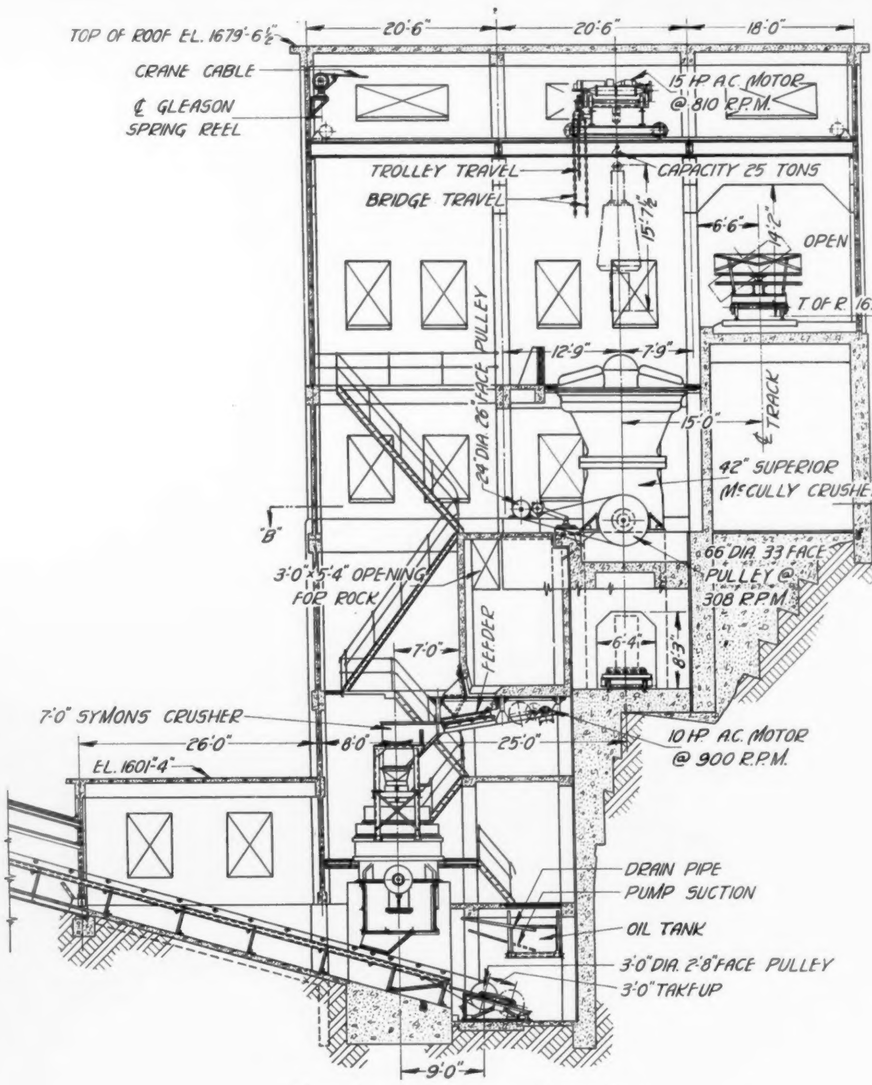


Locomotive and cars at the primary crusher

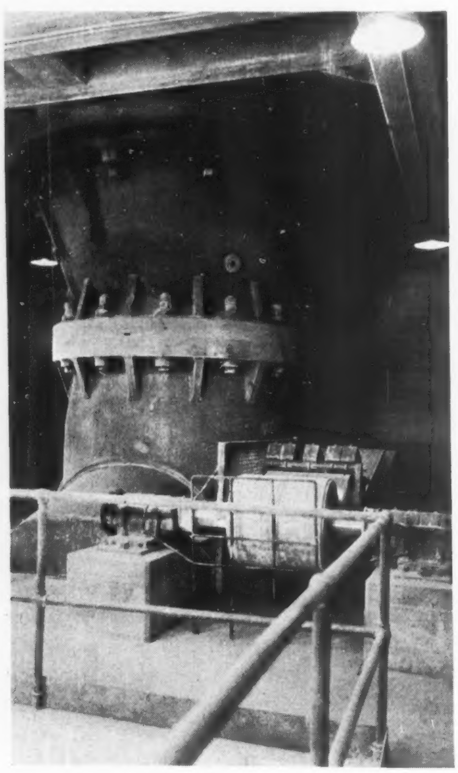
them is a practical impossibility except along certain well-defined trails.

The Olympic Portland Cement Co. operated its limestone quarry for many years at Limestone, Wash., but at a point across the canyon from the present quarry. The old quarry was located near the bottom of the valley at Balfour; the new one is near the top of a mountain several thousand feet high. Through the intervening valley, known locally as the Columbia Valley, passes the stub line of the Chicago, Milwaukee and St. Paul railroad connecting the quarry with the company's cement plant at Bellingham, Wash.

The new crushing plant is of reinforced concrete and steel construction throughout and was designed by F. L. Smidth and Co. of New York. The main crusher buildings, aerial tramway loading terminal, transfer



Elevation through crushing plant



Gyratory crusher and driving belt

terminal and loading silos are of massive design and of pleasing appearance. The floors are of concrete with steel connecting stairs. Spiral stairs on the loading terminal were made by Bacon and Matneson Forge Co. of Seattle.

Construction was started by engineers of the cement company during the spring of 1928 and work completed in May of this year. The construction work was under the direction of Paul P. Kaylor, chief electrician of the Olympic company.

The quarry floor is located 1225 ft. above the floor of the valley and at a very steep angle; approximately a 40% grade, with the crushing plant constructed just below the quarry floor. The crushing plant and loading terminal about 1100 ft. below are connected by a two-stage Leschen aerial tramway—more common in the west than east.

Loading terminal at foot of tramway

To reach the quarry floor and for transportation of the heavy crushing plant machinery a road had to be dug out of the mountain side. The road zig-zags up the side of the mountain and from a distance resembles two complete letter W's in a reclined position. The No. 100-B Bucyrus crawler-mounted, electric shovel with 3 cu. yd. bucket now digging rock at the quarry was used to construct the road and much credit for this work and safe arrival of the shovel at the quarry site should be given W. M. Wells, engineer in charge of the shovel.

Since opening up the new quarry a face 280 ft. high has been exposed which is operated from a single bench. No overburden is removed, for the little foreign material consists of a few inches of top soil, small trees and other vegetation. The quarry face is about 700 ft. long at the present time.

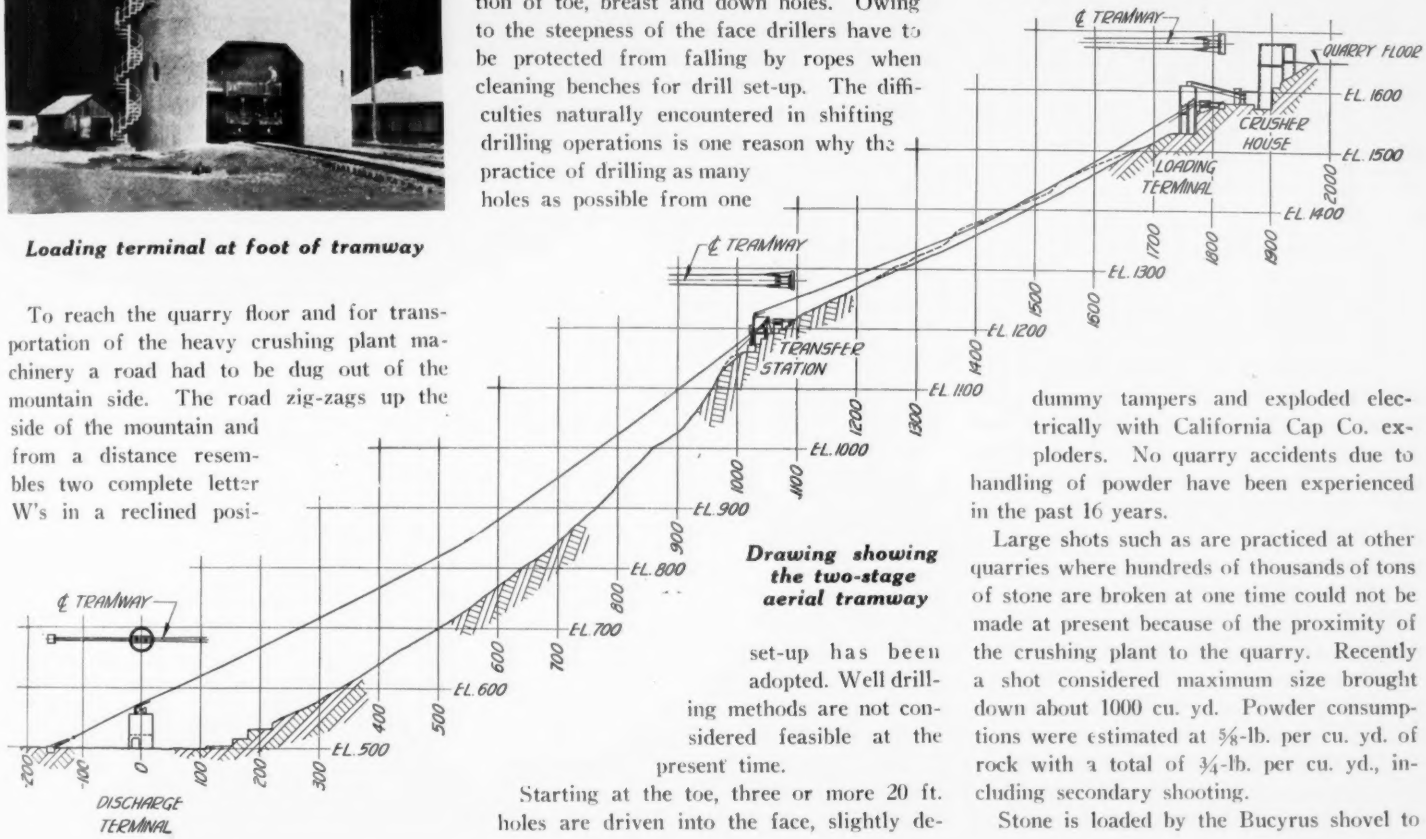
The rock is a blue limestone, quite massive and comparatively hard and outcrops from a ledge that dips into the mountain at an angle of about 70 deg. The strike of the ledge is approximately ½ mile long with a width of ¼ mile or thereabouts.

Primary drilling is all done by Chicago Pneumatic 6's and 5's, tripod mounted, and Denver-Rock "Clippers" No. 55 are used for secondary drilling.

Frank Ristine, superintendent, has spent practically his entire life at mining or quarry work, beginning at Cripple Creek, Colo., during the early boom days. His knowledge of rock handling, quarry methods he has handed down to his son, who has active charge of the details of the operation. The efficient, smooth running operation, the spirit of camaraderie between the department heads and men are evidences of the good management.

Drill holes, using 1¼-in. hollow steel, starting with 2-in. and bottoming at 1⅝-in., are put down into the face using a combination of toe, breast and down holes. Owing to the steepness of the face drillers have to be protected from falling by ropes when cleaning benches for drill set-up. The difficulties naturally encountered in shifting drilling operations is one reason why the practice of drilling as many holes as possible from one set-up has been adopted. Well drilling methods are not considered feasible at the present time.

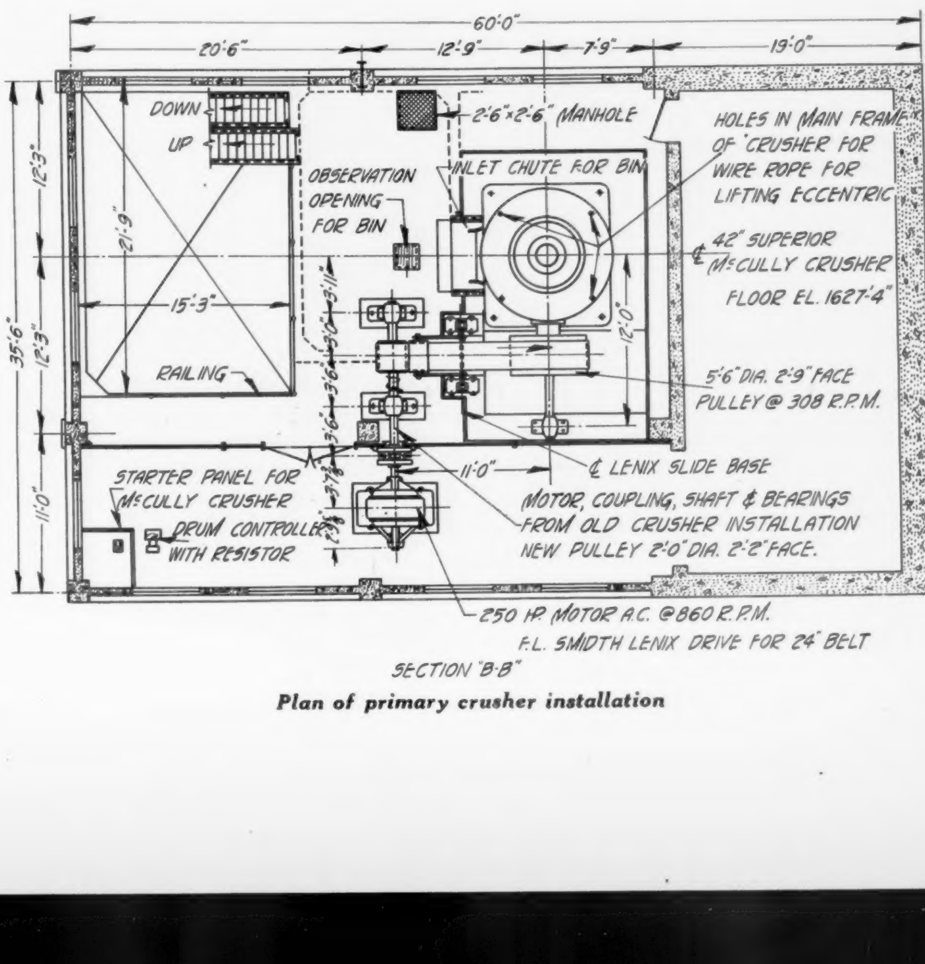
Starting at the toe, three or more 20 ft. holes are driven into the face, slightly depressing at the back end. The holes are drilled from one set-up and fan out at the back. Starting about 18 in. above the toe holes a second set of lifters similarly located and fanned out are put in. If the breast is high and heavy, a third set of lifters or breast holes are driven about 18 in. above the first set of lifters. In addition, a series of 20 ft. down-holes are put down from above on 5 ft. centers so as to come within a few feet of the ends of the breast holes. The holes are all loaded with about 8 ft. of Trojan, 40 and 60% dynamite with two dummy tampers and exploded electrically with California Cap Co. exploders. No quarry accidents due to handling of powder have been experienced in the past 16 years.



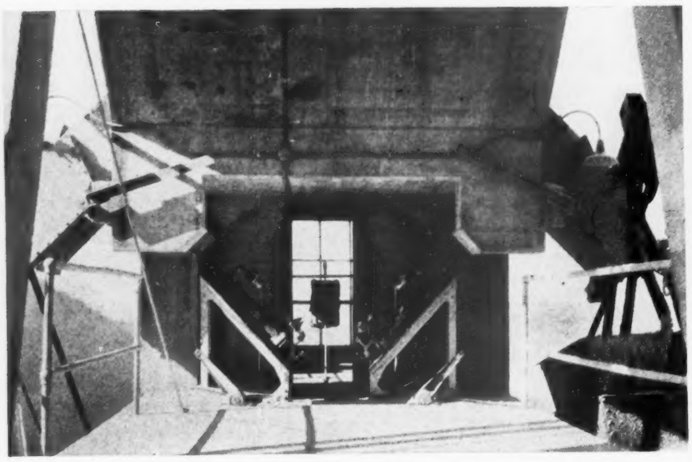
Drawing showing the two-stage aerial tramway

Large shots such as are practiced at other quarries where hundreds of thousands of tons of stone are broken at one time could not be made at present because of the proximity of the crushing plant to the quarry. Recently a shot considered maximum size brought down about 1000 cu. yd. Powder consumptions were estimated at ⅝-lb. per cu. yd. of rock with a total of ¾-lb. per cu. yd., including secondary shooting.

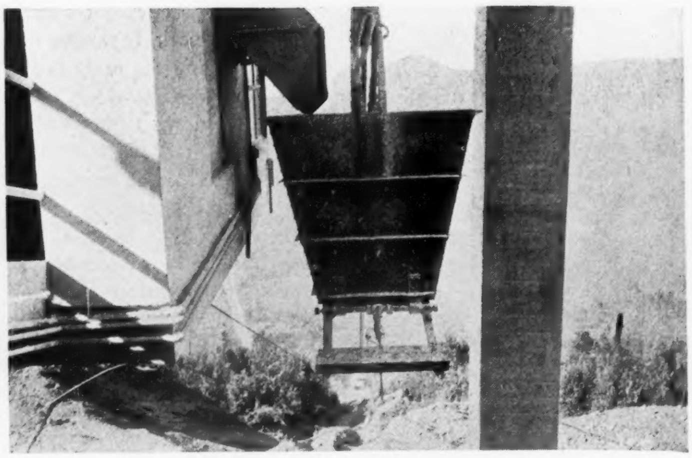
Stone is loaded by the Bucyrus shovel to



Plan of primary crusher installation



Aerial tramway control house with air cylinders for operating gates



Shuttle tram bucket under loading lip at upper loading terminal

side-dump, Western cars, of which there are 18 in. use. Haulage is by means of two 8-ton, McCormick-Deering, gasoline locomotives.

Air for the drills is supplied by an Imperial type 10, Ingersoll-Rand two-stage compressor having a 16x14-in. cylinder on the low side and a 10x14-in. cylinder on the high side. The compressor is driven by a 100-hp. 2200-v. General Electric Co. induction motor through F. L. Smidth and Co. "Lenix" drive. Power for the plant, purchased from the Puget Sound Power and Light Co., a subsidiary of the Stone and Webster Co., is delivered to the plant at 66,000-v. and stepped down to 2200-v. and 440-v. by three transformers owned by the power company.

The quarry cars are dumped to a 42-in. Allis-Chalmers gyratory crusher having a corrugated head. A 25-ton Whiting electric crane spans the crusher house.

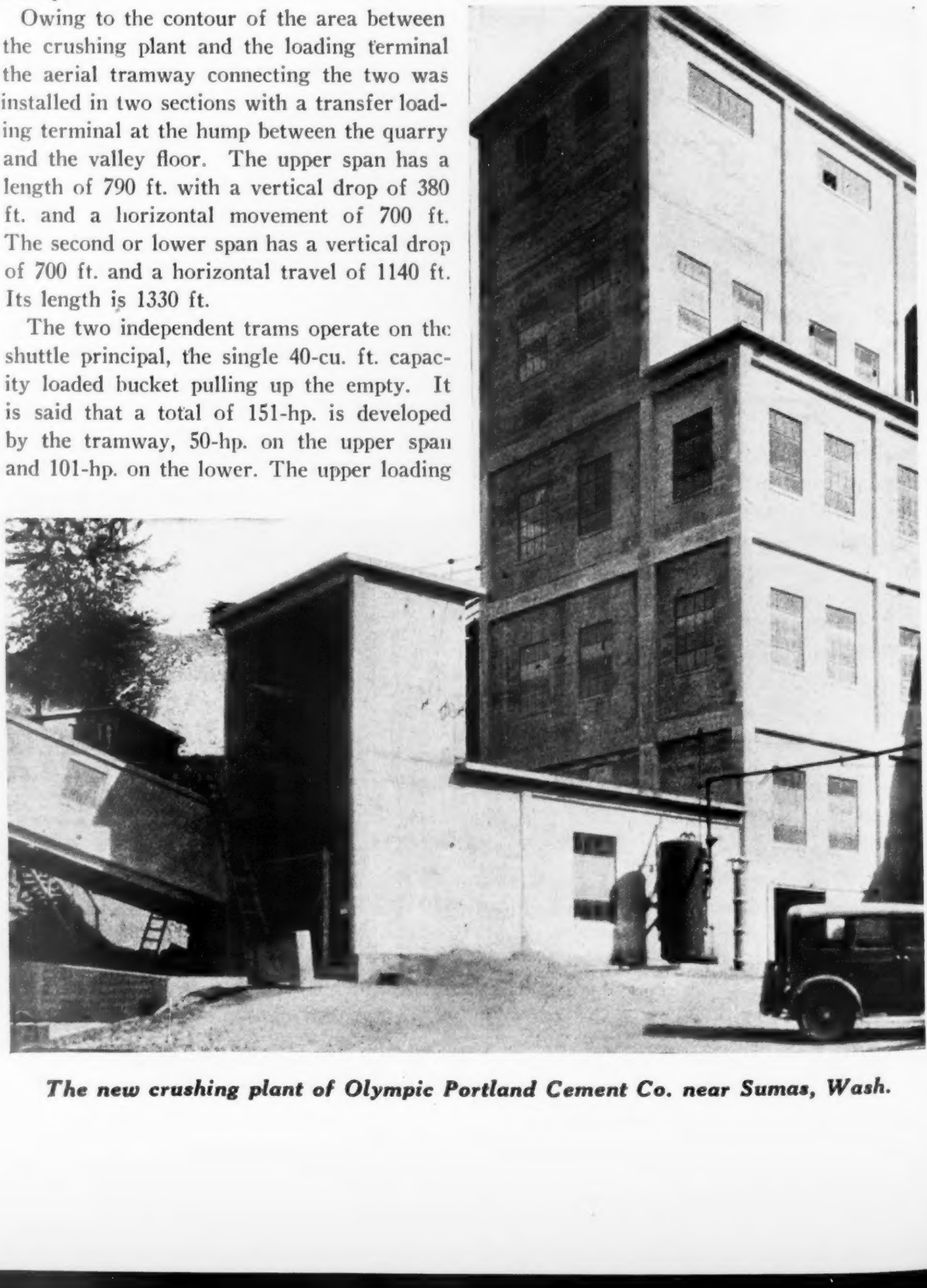
The primary crusher is driven by a 250-hp., 900 r.p.m. General Electric Co. induction motor through a 24-in. leather belt equipped with a Lenix belt tightener. The motor is in a separate room away from the crusher to protect it from unnecessary dust; the outboard shaft is equipped with flexible couplings and extends through the wall to the crusher. Discharge of the crusher, 5-in. and under, passes to a Bodinson Manufacturing Co., San Francisco, Calif., reciprocating pan feeder serving a 7 ft. Symons cone crusher. This is the first installation of a 7 ft. cone crusher in connection with a cement manufacturing operation. The Symons cone is set to deliver a ⅝-in. products at which size the combined crushing units have a capacity of 250 tons per hour. It is unusual for a crusher to be set to such a small discharge size, but the equipment has been found to have sufficient capacity for the needs so a finer crushing here results in less work being done at the "Kominuters" in the cement plant. The cone crusher is direct connected through a flexible coupling to a 250-hp., 435-r.p.m., General Electric induction motor and its pan feeder is driven by a 7½-hp. Fairbanks-Morse induction motor.

A 30-in. belt conveyor elevates the ⅝-in. material 40-ft. and moves it horizontally 134 ft. 6 in., discharging to a 500-ton capacity concrete bin used for loading the buckets at the aerial tramway. The Hewitt conveyor belt rides on Stearns "Rex" carrier and return rolls, all of which are Alemite lubricated. A 20-hp. motor and right angle De Laval 32½:1 gear reduction unit drives the conveyor.

Owing to the contour of the area between the crushing plant and the loading terminal the aerial tramway connecting the two was installed in two sections with a transfer loading terminal at the hump between the quarry and the valley floor. The upper span has a length of 790 ft. with a vertical drop of 380 ft. and a horizontal movement of 700 ft. The second or lower span has a vertical drop of 700 ft. and a horizontal travel of 1140 ft. Its length is 1330 ft.

The two independent trams operate on the shuttle principal, the single 40-cu. ft. capacity loaded bucket pulling up the empty. It is said that a total of 151-hp. is developed by the tramway, 50-hp. on the upper span and 101-hp. on the lower. The upper loading terminal is located under the concrete bins served by the belt conveyor from the secondary crushers and is provided with a loading gate on each side. Both gates are operated by Curtis air hoists and controlled by the hoist operator.

The hoist consists of two brakes on duplicate sheaved wheels controlled from the terminal loading house by means of a suitable lever. The lever is provided with a back



The new crushing plant of Olympic Portland Cement Co. near Sumas, Wash.

cushion so all the operator needs to do to release the brakes is to lean against the brake lever. The brakes are applied by a counter weight.

The first tramway discharges to a 50-ton bin at the transfer house, where similar loading and brake control mechanisms are located. A 2¼-in. Leschen wire rope is used for a track line with a ⅞-in. lead line and a ¾-in. tail line.

The loading terminal is a reinforced concrete silo 60 ft. high and 40 ft. in diameter, holding 1000 tons. Loading of cars is effected by means of six rack and pinion gates which discharge by gravity to 50-ton stand-

Bucket about to discharge into car loading terminal

ard gage gondolas that are owned by the cement company.

The company's blacksmith shop, located near the quarry floor, contains an Ingersoll-Rand drill sharpener, oil furnace as well as the usual run of shop equipment, drill presses, forges, etc.

Sand and Gravel Production Increased in 1928

THE production of sand and gravel in this country in 1928 amounted to 209,118,868 short tons, valued at $119,207,937, according to the United States Bureau of Mines, Department of Commerce. This was in increase of 6% in quantity and of 3% in value as compared with the output of 1927. These increased figures are in part due to a special canvass for new producers throughout the country, which was conducted by the Bureau.

The sand production was 97,737,717 short tons, valued at $56,132,406; gravel production was 111,381,151 short tons, valued at $63,075,531.

New York led all the states in quantity and value of sand and gravel production, with 21,109,864 short tons, valued at $12,572,634. Illinois was second in quantity, its output amounting to 20,969,331 short tons, valued at $10,243,555. California was third, with 15,969,132 short tons, valued at $8,698,884, and Michigan was fourth, with 15,893,090 short tons, valued at $6,828,431. Ohio, Pennsylvania, Indiana and Wisconsin

SAND AND GRAVEL SOLD OR USED BY PRODUCERS IN THE UNITED STATES IN 1928, BY STATES

State	Short tons	Value
State	Short tons	Value
Alabama	3,315,985	$ 1,719,222
Arizona	566,777	282,996
Arkansas	1,683,384	991,408
California	15,969,132	8,698,884
Colorado	806,051	605,511
Connecticut	660,708	479,173
Delaware	68,615	50,209
District of Columbia	1,002,126	759,053
Florida	894,879	495,875
Georgia	744,948	310,569
Hawaii	3,570	10,710
Idaho	716,471	326,278
Illinois	20,969,331	10,243,555
Indiana	11,086,331	5,375,058
Iowa	3,423,619	2,094,955
Kansas	2,760,277	1,532,399
Kentucky	2,100,907	1,589,617
Louisiana	2,310,166	1,503,400
Maine	758,528	348,376
Maryland	2,602,142	2,409,544
Massachusetts	3,751,193	2,986,850
Michigan	15,893,090	6,828,431
Minnesota	4,409,245	2,029,091
Mississippi	3,012,291	1,428,548
Missouri	5,251,226	3,248,813
Montana	1,430,914	465,375
Nebraska	2,234,575	1,265,001
Nevada	201,092	150,966
New Hampshire	1,636,621	1,018,547
New Jersey	6,292,636	4,261,390
New Mexico	187,239	111,296
New York	21,109,864	12,572,634
North Carolina	971,746	531,092
North Dakota	624,700	135,200
Ohio	14,286,169	9,116,356
Oklahoma	2,827,810	1,426,258
Oregon	2,441,945	1,453,070
Pennsylvania	12,955,790	11,289,826
Rhode Island	192,862	56,610
South Carolina	507,716	341,391
South Dakota	2,461,963	1,301,075
Tennessee	2,939,541	2,157,515
Texas	8,007,392	4,602,421
Utah	1,000,131	544,020
Vermont	295,524	108,461
Virginia	1,602,444	1,081,948
Washington	5,917,748	2,001,195
West Virginia	2,383,659	2,773,341
Wisconsin	10,104,015	3,680,420
Wyoming	1,742,880	414,004
	209,118,868	$116,207,937

were next in order in quantity of production. Pennsylvania was second in value of production, with Illinois third.

About 77% of the total production of sand and gravel was reported as washed and screened.

SAND AND GRAVEL SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1927-1928

	1927 Short tons	1927 Value	1928 Short tons	1928 Value
Sand:				
Glass	2,171,693	$ 3,257,790	2,310,828	$ 3,435,645
Molding	4,194,975	4,458,508	4,781,765	5,089,969
Building	40,737,377	22,198,767	45,629,207	24,116,772
Paving	35,606,622	17,767,491	35,244,544	17,305,750
Cutting, grinding and blast	1,686,762	2,193,690	1,538,046	1,991,962
Fire or furnace	410,801	452,835	305,659	362,044
Engine	2,618,890	1,640,736	2,413,043	1,544,204
Filter	74,674	155,137	113,978	226,896
Other*	6,086,545	2,166,444	5,400,647	2,059,164
	93,588,339	$ 54,291,398	97,737,717	$ 56,132,406
Gravel:				
Building	30,432,031	21,947,666	34,747,235	24,071,208
Paving	44,891,975	29,887,365	49,088,786	30,697,993
Railroad ballast†	28,541,924	9,403,357	27,545,130	8,306,330
	103,865,930	$ 61,238,388	111,381,151	$ 63,075,531
Grand total	197,454,269	$115,529,786	209,118,868	$119,207,937

*Includes some sand used for railroad ballast and fills. †Includes some gravel used for fills by railroads.

Ohio Limestone Production Increases

PRODUCTION of limestone in Ohio is increasing while that of most forms of sandstone is decreasing, figures for 1928 compiled for the division of labor statistics in the Ohio department of industrial relations show. While there is a decreased demand for sandstone for general building purposes, it is gaining popularity as material for use in erecting burial vaults and for whetstones, while limestone's principal gains are for ballast and road purposes, blast furnace fluxing and in manufacture of cement.

The limestone production was 16,317,213 tons in 1928 as compared with 15,663,399 in 1927. The largest tonnage was 6,492,597 for macadamizing and ballast, this being a gain over the 6,218,151 tons used for road work in 1927. There is a decrease from 189,704 to 165,934 in the amount required for agricultural purposes, the report reveals, and the one-time popular flagstone for sidewalks is losing, only 256 tons being used for that purpose against 355 tons in 1927.

Sandstone as curbing shows a decrease of 400,000 tons from 1,886,995. Silica sand output, principally produced in Portage, Perry, Jackson, Tuscarawas, Wayne, Stark and Summit counties, was 448,540, an increase over 417,763 for 1927. Burial vaults accounted for 149,361 tons, an increase of 7000 tons over 1927.—*Martins Ferry* (Ohio) *Times.*

Pontiac-Fairbury Limestone Resources

THE ILLINOIS STATE GEOLOGICAL SURVEY has recently issued Bulletin No. 17, "The Limestone Resources of the Pontiac-Fairbury Region," copies of which are available at 50 cents.

The report gives the results of an investigation which has been made to determine the suitability of the limestone for cement manufacture, agricultural limestone, macadam roads, concrete aggregate, flux, lime manufacture, and railroad ballast. It is illustrated with map diagrams showing the positions of the quarries with reference to railroad transportation and also contains other data.

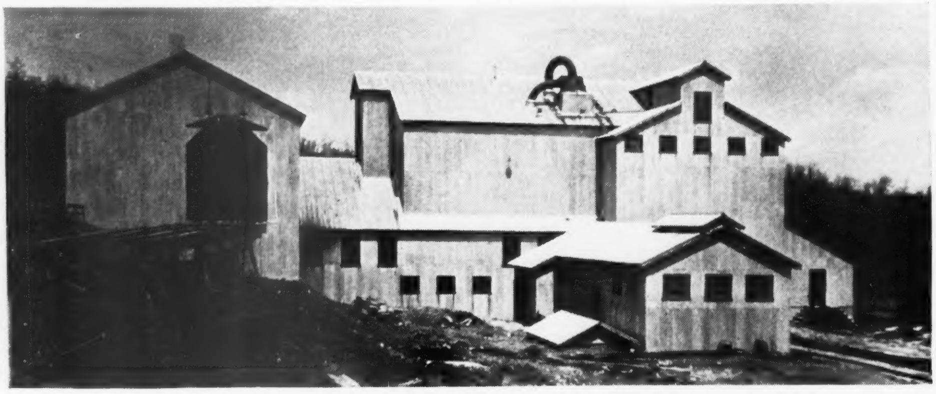
New Feldspar Grinding Mill

Feldspar Milling Co.'s Plant at Burnsville, N. C., Uses Tractors and Trailers for Haulage and Has Other Novel Features

By H. J. Bryson
North Carolina State Geologist, Raleigh, N. C.

THE NEW FELDSPAR grinding plant of the Feldspar Milling Co., Burnsville, N. C., which began operations about May 15, 1929, was the first electrically operated feldspar mill ever designed. The average production of finished spar is about 100 tons per 24-hour day, all of which is produced under strict laboratory control, an analysis accompanying every shipment. It is marketed under the trade name of "Celospar," a name taken from Mt. Celo from which the spar comes; the Harshaw Chemical Co. are the exclusive sales agents for the product.

The Feldspar Milling Co. owns in fee 2000 acres of mountain land on which 10 pegmatite dikes occur. These dikes vary in width from a few feet to 200 ft. or more and can be traced by outcrops for a distance of two or three thousand feet. Several engineers and geologists examined the property and all were very much pleased with the possibilities, among them being Heckenbleikner, consulting engineer, Charlotte, N. C., who stated that it was the largest and most accessible deposit of feldspar in North Carolina. H. S. Brownfield, mining engineer from Pittsburgh, after a thorough examination, reported "that there are ten pegmatite dikes varying in width from 10 to 300 ft. which run through the entire mountain and contain some of the best spar found in the state." He also stated that there was sufficient spar in sight to supply the mill at full grinding capacity indefinitely. The writer also personally examined the property and is willing to agree that it is one of the largest undeveloped properties in North Carolina.



New mill of Feldspar Milling Co. at Burnsville, N. C.

Up to the present time, all of the prospecting done on the property has been confined to the outcrops of the dikes on the mountain side next to the plant. Eleven pits and mines have been opened, all of which show a good grade of spar. The largest opening, formerly worked by the Clinchfield Products Co., is known as the "Clinch Mine." This mine is an open pit mine from 20- to 30-ft. in width, 100 ft. deep at the deepest place, and follows the dike for 300 ft. One of the views shows the exposure of spar at this mine. The relative size is shown by the man with wheelbarrow in the center foreground. From this mine and the immediate locality the company expects to get enough spar to supply the plant for the first few years. The only spar purchased from mines other than from the company's property is that necessary for blending purposes.

The mining of the spar is done by the usual method, that is, by the open pit-bench method. The drilling is done, at present, by compressed air drills driven by a gasoline engine. The spar, after being blasted down, is hoisted by an electric driven hoist to the stock pile. Usual hand-cobbing methods of separating the feldspar, mica and flint (quartz) employed at all feldspar mines in this state have been replaced by a crusher and picking belt. A portable 14 by 22-in. Reliance jaw crusher, electrically driven, with a daily capacity of 150 tons, is used to crush the crude material to the desired size. A portable type of crusher is used in order that it may be taken from one stock pile to another.

Exposure of feldspar at one of the mines

The crude spar, after being crushed, falls on the picking belt, a Hercules "Special," 160 ft. on centers, with a capacity of 150 tons per day. Six men are employed at the picking belt to separate the marketable spar and mica from the gangue, which is left to stay on the belt to be carried to the waste dump while the marketable material is thrown by hand into crude storage bins. The tipple is 24- by 36-ft. and has four storage bins, each 12- by 18- by 15-ft. with a capacity of 50 tons each. The spar is separated as it goes into the bins into the various grades desired by the trade. The

No. 1 pottery spar contains no free silica or quartz, the No. 2 contains as high as 10% free silica, while the No. 3 or glass makers' spar contains as high as 25% free silica.

The grading of the spar at the picking belt may be done by male or female help, but in either case only those who know thoroughly the various grades of spar are employed. Each "picker" has a particular type of spar to take from the belt. In this manner the spar is separated with surprising accuracy to the various grades. The laborers become skilled "pickers" after only a few days of intensive training.

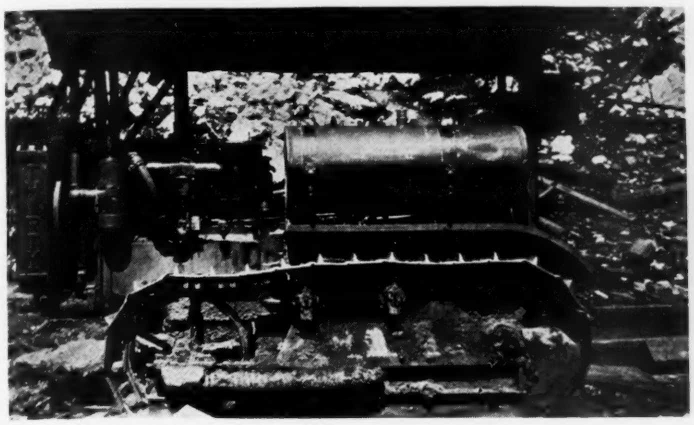
The crude graded spar is transported by a No. 30 Caterpillar tractor and Athey 4½-ton trailer to the plant one mile away. It is estimated that the transportation of the spar by this method is approximately 35 cents per ton. The spar is loaded into the trailer by gravity from the bins thereby eliminating the old type hand-shovel method. When the spar reaches the plant it is dumped from the trailer into a series of 13 crude storage bins, the different grades going to the respective bins. Since the spar is graded at the tipple no further grading is necessary at the plant. It is said that this method of transporting the spar from the mines to the grinding plant is the cheapest yet employed by any company in the state.

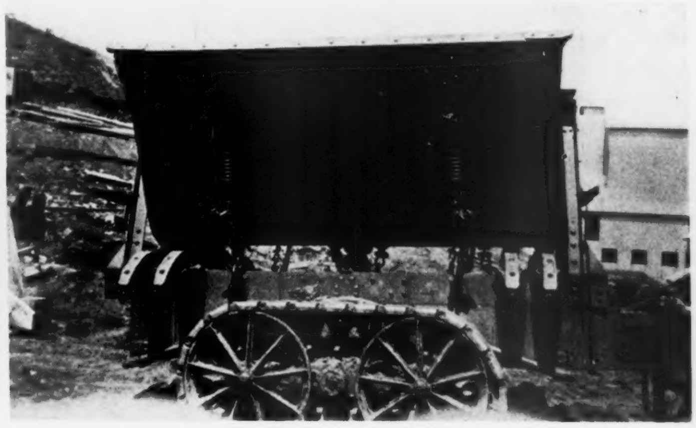
The plant is composed of three parts, the first, 99 by 39 ft., contains the crude storage bins; the second, 62 by 54 ft., contains the machinery; and the third, 50 by 65 ft., has the storage bins for the finished spar. In addition to these storage bins, there is ample storage space for the finished spar that is sacked before shipping.

In addition to the main plant there is a machine shop 20 by 60 ft., fully equipped to make any necessary repairs. There is also an office building separate from the plant as well as a fully equipped laboratory. A full time chemist, with an assistant, is employed to make analyses of each shipment. The chemist not only makes chemical analyses but physical analyses such as screen tests, fusion tests, etc., as well. This feature is in keeping with the policies of the modern feldspar producers since the present day consumers demand a physical as well as a chemical analysis.

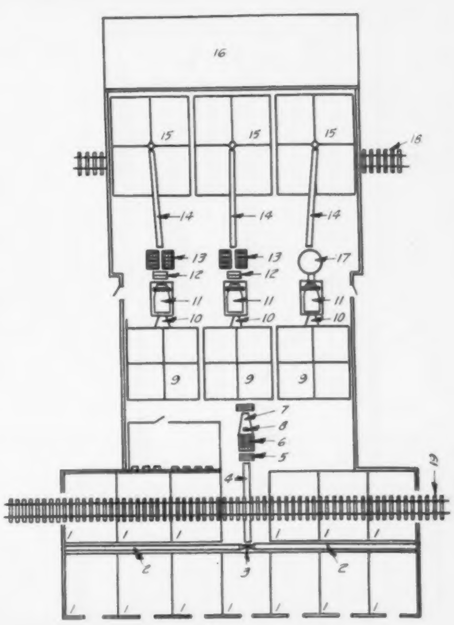
When the crude spar reaches the plant it is weighed and stored in the primary bins, 13 in number, 14 by 18 ft., with a capacity of 60 tons each. These bins give ample storage space for the spar necessary to keep the plant operating for a period of 10 days or more at full capacity. They hold the reserve supplies of material to forestall any shortage due to the closing of the mines because of unfavorable weather and also store the different types of spar for blending purposes.

The crude storage bins are arranged in two parallel rows, seven on one side and





Crude graded spar is transported by a tractor and 7-cu. yd. trailer to the plant



KEY TO DIAGRAM

1. Crude storage bins, 13 in number, 14 by 18 ft.
2. Lateral conveyor belts, 48 ft. long.
3. Primary Universal crusher.
4. Conveyor belt, 23 ft. long.
5. Bucket elevator, No. 1, 23 ft. long.
6. Link-Belt screen, 2 by 5 ft.
7. Gravity chute from screens to bucket elevator No. 2.
8. Bucket elevator No. 2, 42 ft. long.
9. Intermediate storage bins, 12 in number, 10 by 17 by 11 ft.
10. Automatic feeders fer ball mills.
11. Hardinge bell mills.
12. Bucket elevators for glass spar units.
13. Link-Belt screens, 3 by 5 ft.
14. Conveyor belts to and from screens to storage bins.
15. Storage bins, 12 in number, 10 by 17 by 11 ft.
16. Shed for additional storage.
17. Air classifier.
18. Railroad under finsihed storage bins.
19. Railroad over crude storage bins.

Plan diagram of the mill

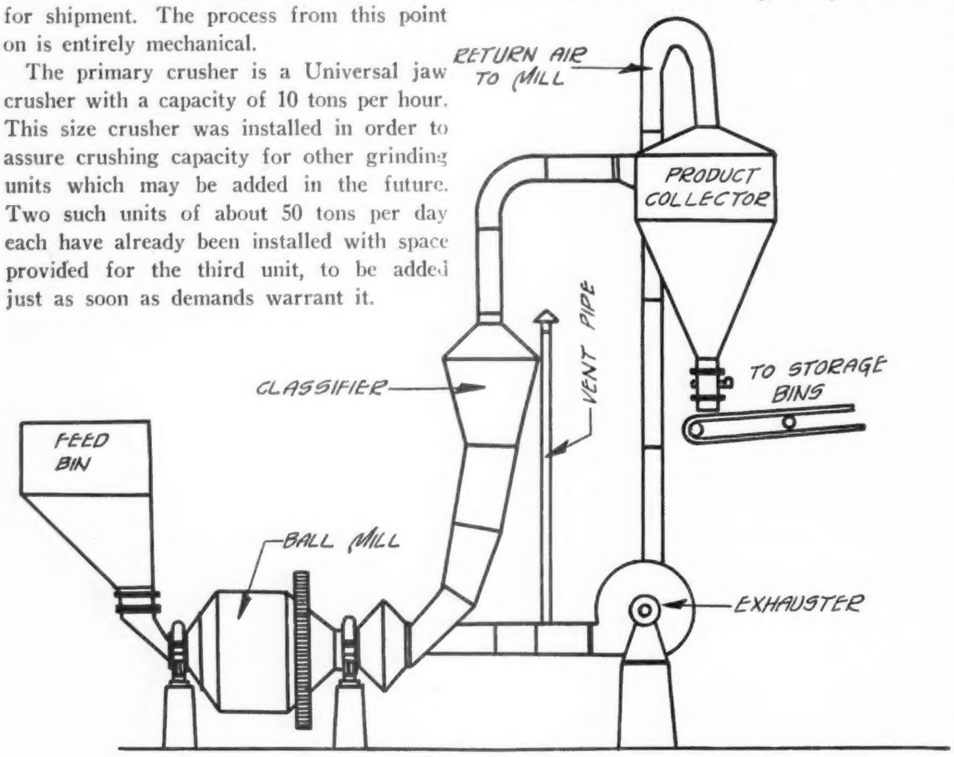
Tipple and storage bins for crude feldspar

six on the other between which are conveyor belts. The middle bin on the side next to the plant is occupied by the primary crusher. Two Hercules conveyor belts, eacn 48 ft. on centers, carry the crude spar from the bins to the crusher which is below the level of bin floors. The conveyor belts are also slightly below the bin floors so that the spar may be shoveled on them with little effort. After the spar is loaded on the belts it is not handled again until it is ready for shipment. The process from this point on is entirely mechanical.

The primary crusher is a Universal jaw crusher with a capacity of 10 tons per hour. This size crusher was installed in order to assure crushing capacity for other grinding units which may be added in the future. Two such units of about 50 tons per day each have already been installed with space provided for the third unit, to be added just as soon as demands warrant it.

two Link Belt 36-in. by 5-ft. screens, each of 2-ton per hour capacity. Rejects of these screens goes back to the ball mill for regrinding; the fines go to a belt conveyor running to the storage bins. Since there are four grades of glass makers' spar, 12-, 20-, 40- and 60-mesh, there are four storage bins for this unit. These bins are 10- by 17- by 11-ft. and each holds 50 tons.

The pottery spar unit is also a Hardinge conical ball mill 48-in. by 8-ft., with a



Details of the closed circuit pottery spar grinding unit

From the primary crusher the spar, which has been reduced to minus 1-in. falls on a conveyor belt 23 ft. on centers which carries it to the foot of bucket elevator No. 1. This elevator has a capacity of 10 tons per hour and raises the spar 23 ft. to an inclined 24-in. by 5-ft. Link-Belt vibrating screen. The fines, minus ½-in., are chuted to the bottom of bucket elevator No. 2 while the rejects go to the secondary crusher, also Universal jaw crusher of 7-ton per hour capacity. The recrushed spar passes to the same chute serving the throughs of the vibrating screen.

Bucket elevator No. 2 has a capacity of 10 tons per hour, is 42 ft. on centers and carries the crushed spar to 12 intermediate storage bins. These bins are 10 by 17 by 11 ft. with a capacity of 50 tons each and are arranged in groups of 4 each so that further blending may be made if necessary. From these intermediate bins the spar is fed by automatic feeder direct into the Hardinge conical ball mills.

The Hardinge mill for the glass makers' unit is 48 in. by 8 ft., has a capacity of 3 tons per hour and is driven by a 75-hp. electric motor. The ground spar goes by Jeffrey bucket elevator 46 ft. on centers to grinding capacity of 1½ tons per hour and air classifier in closed circuit with the ball mill. This type of mill has been recently adapted to grinding feldspar and at this plant it has proven an entire success, leaving the plant free from dust at all times.

The discharge of the air classifier is carried by a 24-ft. (on centers) belt conveyor to the storage bins. For this unit there are 4 50-ton bins each 10- by 17- by 11-ft. The finished product consists of four grades screened to four sizes: 90-, 140-, 200- and 225-mesh. Any type of pottery spar, regardless of analysis or mesh, is produced from this unit.

The entire operation employs about 100 men of which 75 are at the mines and the remainder at the picking belt and grinding plant. Taking all things into consideration this company should be able to produce feldspar as cheaply as any in the state.

Analysis of Bauxite

RESEARCH paper No. 5, "Analysis of Bauxite and of Refractories of High Alumina Content," by G. E. F. Lundell, chemist, and J. I. Hoffman, associate chemist of the U. S. Bureau of Standards, describes an analytical method, as the title of the pamphlet implies.

A study was made of the analytical details involved in the analysis of bauxite and burnt refractories of high alumina content. The work has shown that an accurate analysis of these materials is a far more difficult problem than it is ordinarily thought to be. In spite of the fact that the determination of alumina is usually regarded as very simple, extreme values of 54.84 and 56.68% were reported by the analysts who co-operated on the analysis of the Bureau of Standards' standard sample of bauxite No. 69 (actual Al_2O_3, 55.06%). The results for alumina and silica reported in the analysis of the standard burnt refractories Nos. 76, 77 and 78 were even less satisfactory. The improper drying of bauxite and the difficulty of putting burnt refractories into complete solution were found to be sources or error.

Multi-Wall Paper Bags for Feldspar

THE FELDSPAR GRINDERS' INSTITUTE, INC., announces that its members will adopt the use of the five-wall paper bag designed to hold 100 lb. of feldspar, for the shipment of feldspar instead of burlap bags. This decision was made after a special committee and the institute as a whole considered the matter very carefully.

At a recent meeting of the F. G. I. held in Atlantic City it was considered to be of mutual advantage for the manufacturer and the customer to change to these paper bags. This change will go into effect as of December 1, 1929, the bags to be billed to the customer at cost and not to be returnable. Up to December 1, 1929, the burlap bags will be handled in the same manner as before by the F. G. I. members. The advantages and disadvantages of this subject were considered by the members and it was felt that the adoption of paper bags would mean less loss of spar, less contamination in transport, less breakage in packing and shipping, as well as the packages being waterproof and easier to handle in transport.

It is expected that this will be met with considerable favor throughout the trade.

Reference Book on Cement and Concrete

THE 1929 general reference book on cement and concrete, recently released by the Portland Cement Association, is a handy compendium on useful information on the cement industry. It gives considerable data on the manufacturing processes, uses of cement in highways, buildings, concrete products, etc. Statistics concerning cement production and consumption, concrete yardage in the United States, highway construction and maintenance, etc., are also given.

Diesel Engines in the Rock Products Industries

Part III—Cement Mills and Quarries

By Orville Adams
Dallas, Texas

ROCK PRODUCTS INDUSTRIES in general have recognized for many years the well-established technical advancement represented by the Diesel engine, and these industries are classed as among the major users of this type of prime mover. Many of the pioneers and leaders of the industry today early selected the Diesel as a source of power for cement plants and are buying engines today of larger power to meet the continued expansion of the industry.

The foresight, vision and faith of the pioneer users of Diesel engines in the cement industry contributed no little to the general industrial recognition of the Diesel. Remarkable records of operation were established by cement plants ten to fifteen years ago, and these same plants today are the largest users of the Diesel. More than a decade of varied experience is available that establishes unquestionably the many claims made for the Diesel as the cheapest method of generating industrial power. This record is even more remarkable when certain factors are taken into consideration:

Factors to be Considered

1. Power cost was not a major problem of the earlier cement plants, and ranked below the necessity for a local market, proper location, and the right materials.

2. The engineers and engineering experience and advice available to the earlier cement plant builders were obviously steam and steam only. That so many early discovered the Diesel is solely a tribute to their own foresight and advanced knowledge, and not to the conventional engineering of the day, which was without Diesel experience, or knowledge of a substantial nature of any kind, concerning this prime mover.

3. The large amount of power used in cement plants at the present time and the desirability of the load from a purchased power standpoint makes available to this industry, in almost all sections of the country, low rates and attractive contracts for electrical power. The Diesel engine, however, contributed in no small measure to this advantage now enjoyed by the industry, thanks to the pioneers who installed their own Diesel plants and brought forth records that had to be reckoned with.

Despite these attractive power rates, the Diesels in cement plants are still on the job 24 hours a day, some of which are more than 15 years old and still going strong.

Trends in the Industry

This very condition of cheap power, however, has aggravated the power cost problem by increasing its importance in this industry, not only because of increased competition brought about by the multiplicity of cement plants and the ever-present necessity to increase consumption, but also the continued improvement and development of new machinery and methods of eliminating man power and adding more mechanical power, per unit of output. In addition, the resultant obsolescence of equipment and method has assumed serious proportions, affecting cost of production and necessity for volume, hence higher power cost without better load factor, and a number of other complications of which the first cement makers had no experience.

Only recently, while on a trip through the Southwest, the writer observed new plants nearing completion and, in the same localities, older plants undergoing, or ones that had recently undergone, remodeling, rebuilding or modernizing to meet the new competition. Plants which formerly were open for any idle visitor are fenced up and a "No Visiting" sign is on the gate. Processes are jealously guarded and methods used kept secret. Alert attendants kept a weatherly eye open for anything that resembled a consulting engineer. Obviously greater necessity for economy and more output is becoming acute. It might therefore be assumed that the importance of low power costs, together with the most nearly reliable and dependable power can be taken for granted. In some of the plants visited the presence of the Diesel with its long record for reliability was discussed, and in these plants there was considerable enthusiasm for Diesel power. In nearly every case the economy and cost had been so well established that the conditions had little or no effect, and the results were quite uniform. The total and final costs varied little and were well in keeping with the average estimates so frequently made for total Diesel power costs.

Author's Outline

I. General view of the field for applications.
- *1. Cement plants. Earlier uses.*

II. Specific applications and comments—plants using Diesel engines. Illustrations.

III. Comparative cost study of Diesel applications. Comparative efficiencies.
- *5000-kw. plant.*
- *Cost of plant.*
- *Cost of power—analytical study.*
- *Fixed charges.*
- *Total power costs.*
- *Space required.*

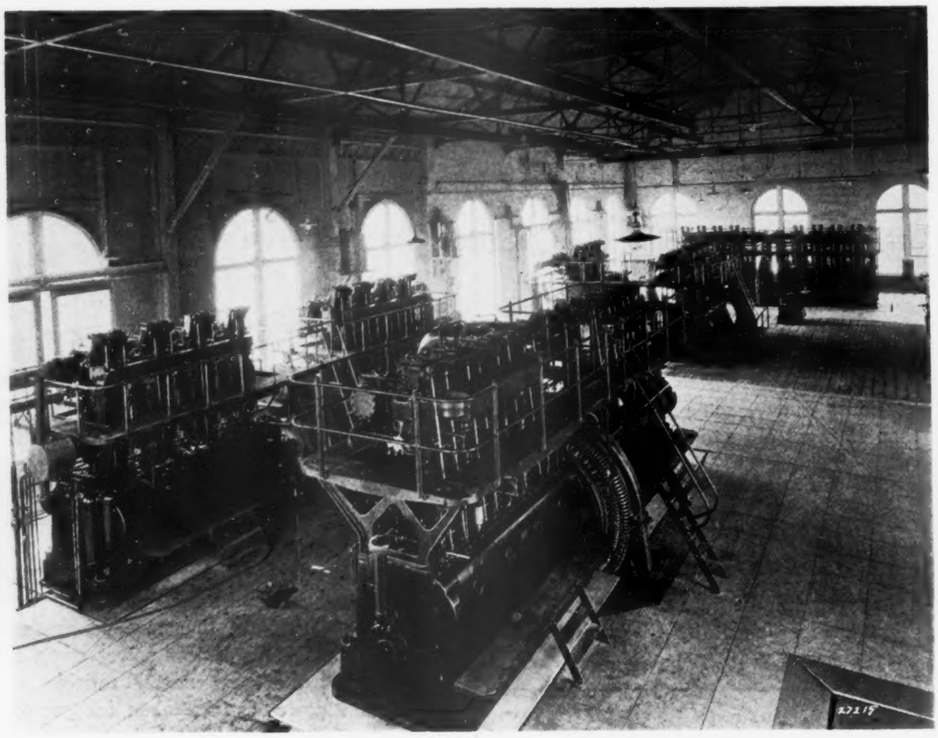
IV. Well-designed features of Diesel plants.
- *Pyrometers.*
- *Lubrication.*
- *Water.*
- *Fuel oil.*
- *Filters, etc.*

V. Conclusions.

Diesel Manufacturers Cooperate with Customers

The operating experience and methods were also quite similar and uniform, and the history of the different installations was practically the same, with regard to the ordinary difficulties of operation, the practice in vogue in maintenance, repair and operation. The builders of the engines in most cases had faithfully co-operated with the users throughout the years in obtaining the best possible service from the engines, in supplying information, helpful suggestions and instructions as to the care and upkeep of the machinery. Repair costs on the whole had been moderate, and wherever excessive, due apparently to neglect more than inherent faults of the engines.

All of these things were freely discussed and admitted by the engineers and operators in charge. These men are sincerely devoted to their engines, giving them diligent care and intelligent attention. Wherever sufficient capacity is installed, or any standby available at all, there were no records of complete shutdown or serious interruptions experienced where the proper foresight was used. Much experience has been gained by the operators, until continued flow of power is assured at these plants as long as they are manned by trained forces. The training of competent operators by the chief engineers



General view of the 5500-hp. Diesel power plant at the San Antonio Portland Cement Co., San Antonio, Texas

for replacements is given careful attention in most cases, with the result that reliable men are kept available for operation of the plants. The necessity for technically trained operators is, however, not apparent even in the largest plant, most of the operators and engineers being good practical men with open minds and an interest in the work. High-priced attention is not only not used but isn't considered necessary.

This is made possible in well-designed power plants where attention to the necessary auxiliaries and equipment has been considered and adequate facilities are available for operation. One thing noticeable in these cement mills is a well-laid-out power plant. In nearly all cases liberally designed power houses were provided, and every possible thought given to successful operation facilities.

Power Requirements in Cement Mills

The power requirements for the manufacture of a barrel of portland cement in a modern plant are usually about 18 kilowatt-hours when all the equipment is motor-driven. More current than this is usually consumed, unless very ample provision is made for power factor correction, and all efforts to improve the load factor are constantly made. When using purchased power, the line losses have been considerable and a low power factor is observed in many cases due to these factors. In one plant where a part of the load was carried by the oil engines and the balance was purchased power, the power factor meter on the oil engine switchboard ran as high as 0.9, while the purchased power panel meter read less than 0.7. The varying

Fig. 3. Twin Diesel engines direct-connected to a generator at the San Antonio Portland Cement Co.

and dragging load, regardless of the type of motors used, seems to be the cause, and the company was penalized very heavily for this low power factor.

It is a well-known fact that the power requirements vary to a considerable extent in a cement plant, unless operation is steady and continuous. However, where the Diesels were used, this variation affected the cost of operation or current at the switchboard but very little. The engines usually show very high efficiencies even at partial loads. Whenever the load dropped, an engine could be shut down, and hence a high load factor is maintained for the units in operation. Usually the plants have two or more units, occasionally several units, added one or two at a time as the business had grown over a period of years.

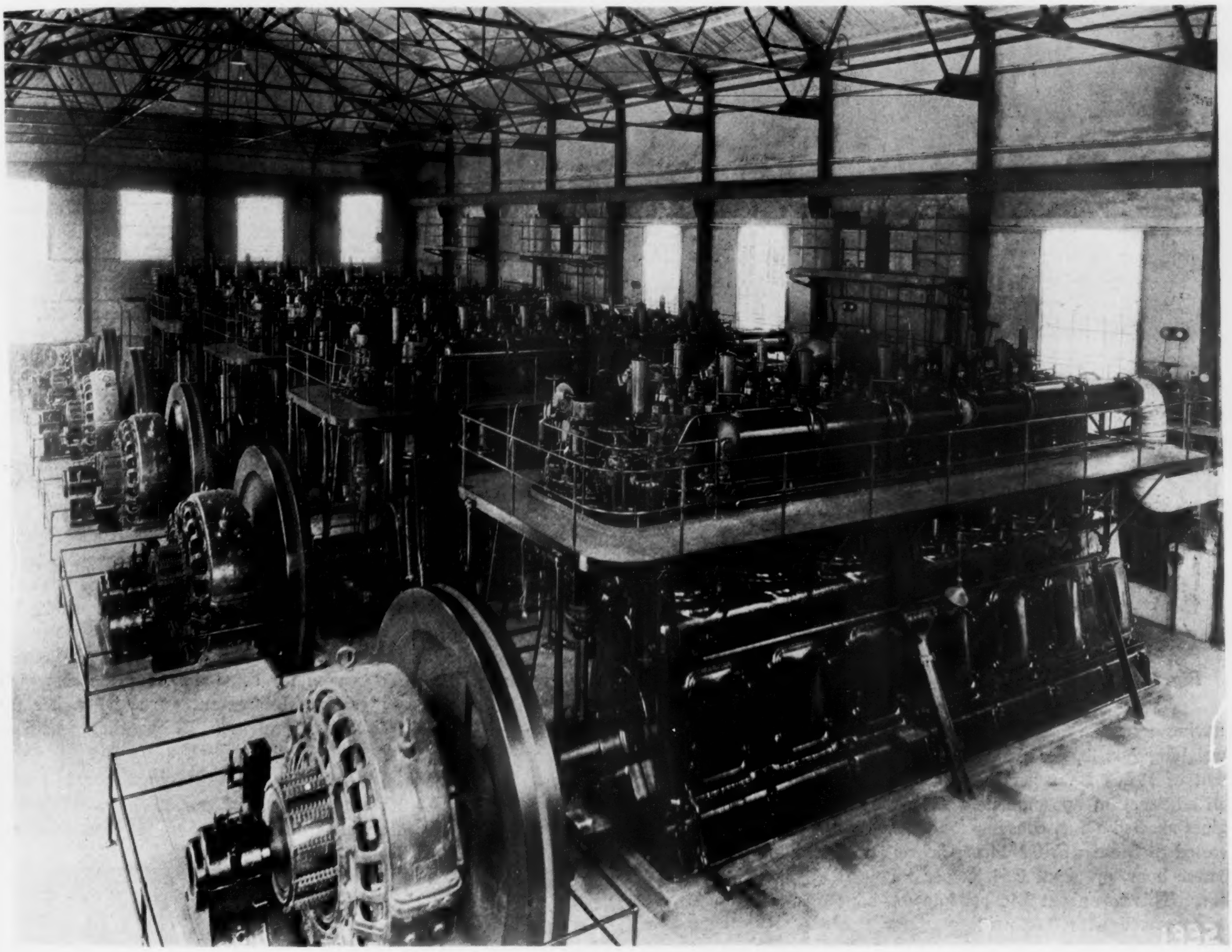


Fig. 5. Five 1000-hp. Diesel engines at the Iola, Kan., mill, Lehigh Portland Cement Co. These engines are direct-connected to d.c. generators

Typical Installations

A very typical installation and application of the Diesel engines in cement plants is at the San Antonio Portland Cement Co. (ROCK PRODUCTS, October 1, 1927), where 5500 hp. is in use. The latest unit, a 1500-hp. Ingersoll-Rand, has just been installed.

The San Antonio Portland Cement Co. plant is one of the oldest in the Southwest, organized in 1880, and has steadily grown with the industry and that section since that time. It is at present one of the largest in capacity in that section, and is completely modernized, the modernizing-expansion program inaugurated several years ago having just about been completed.

About 1911 the company entered one of its expansion programs and faced the necessity for adequate power. Even though petroleum was available at the time in Texas, it was considered too high in price then to compete with the well-known Texas lignite, which could be delivered at the plant for $1.50 a ton. The method of burning this lignite by means of a coal-lignite gas producer and the use of a gas producer engine was decided upon as offering a solution to the prime mover problem. Accordingly, the company purchased a Rathburn, vertical, 4-cylinder, producer-gas engine made by the Rathburn-Jones Engineering Co. and sold exclusively by the Ingersoll-Rand Co. This engine was a 21½x24-in. cylinder and developed 500 hp. at 200 r.p.m. A similar unit was purchased the following year (Fig. 2). The engines were direct connected to Crocker-Wheeler generators, as shown in the illustration. In 1913 a third unit was purchased, this time consisting of two or twin engines of like size, but connected to a single generator, as shown in Fig. 3, and rated at 1000 hp. This engine was direct connected to a General Electric generator.

Changed to Diesel Power

When oil became more plentiful and the price of lignite considerably increased, consideration was given to the question of Diesel engine power. By 1922 lignite was $3.50 a ton, the price of labor for handling the producer had increased, the engines and the producers were in need of extensive overhauling. Accordingly the company accepted the suggestions of the manufacturer to change these engines to Diesels by incorporating the Price direct injection system, which was done, and the engines were overhauled, cylinders, pistons and rods changed together with heads, and the engines made into Diesels.

At that time the company was also burning oil in the kilns and the same oil could be used for the Diesels. According to Charles

Baumberger, president of the company, the Diesels were saving the company $100 a day in 1923, over the cost of producing the same power with lignite producer-gas engines.

For many years the oil used was the "Mirando Crude" from the Laredo, Tex., field, having a specific gravity of 22 deg. Beaumé, weighing 7.68 lb. per gal., with a heat content of 19,200 B.t.u. per lb. With an overall efficiency of approximately 92%, the engines showed a fuel consumption, when converted to Diesels, of 0.3714 per brake horsepower hour, or about 0.54 lb. per killowatt hour. This was about 0.4c. per kilowatt hour as compared with 0.7c. with producer gas. The lubricating oil consumption averages 1 gal. for about 4000 hp.-hr. With a production of 4000 to 5000 bbl. per day and a power requirement of 18 to 20 kw.-hr. per barrel, the daily saving with the present plant of 5500 hp. would be very considerable unless current could be bought well under 1c. per kw.-hr.

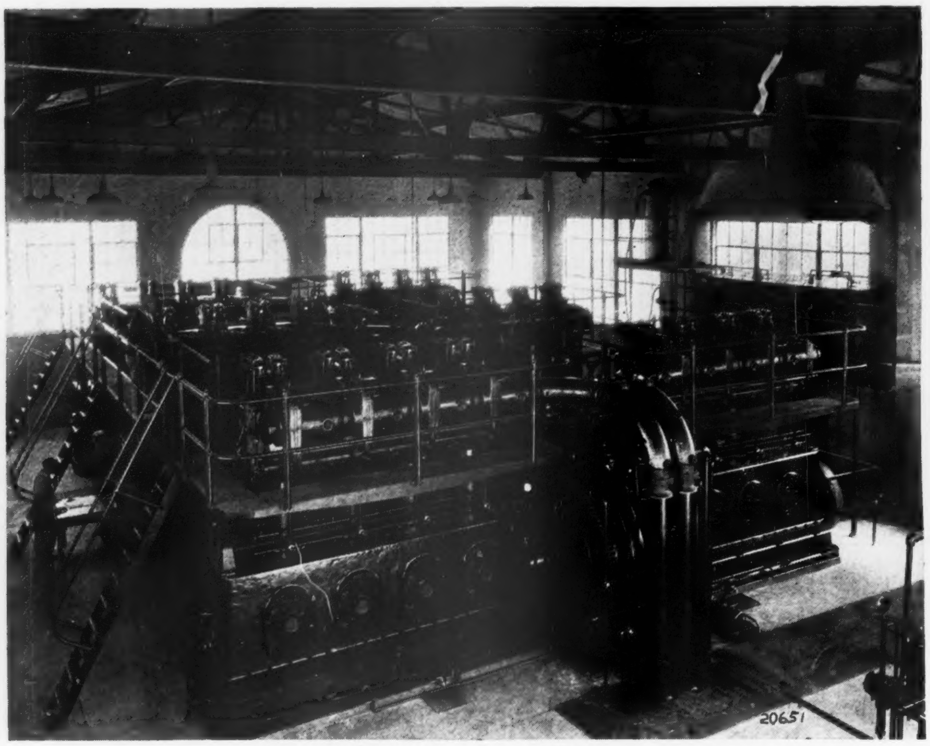


Fig. 6. Three 800-hp. engines driving a. c. generators in a western gypsum plant

Kansas Plant Using Oil Engines

Another 5000-hp. Diesel-engine power plant for a cement mill is the Lehigh plant at Iola, Kan. In the illustration, Fig. 5, are shown five 1000-hp. McIntosh and Seymour Diesels, a plant that has been in successful operation for some years, and has been written about in the engineering and trade journals.

It will be noted that these engines are direct-connected to direct-current, separately excited generators. The neat and clean appearance of this plant is suggestive of many larger oil engine plants where care is given to proper operation.

In Fig. 6 is another large installation operating at a high altitude in Gerlach, Nev. It is reported that the cost is well under a cent a kilowatt hour at this plant. These engines consist of three 800-hp. Ingersoll-Rand, Rathburn-Jones engines, direct connected to General Electric generators. These engines employ the Price direct injection system without the use of compressed air. In this plant are also Cameron pumps and Ingersoll-Rand compressors.

One of the Texas Portland Cement Co. plants also has used Diesel engines since 1915, consisting of two 530-hp. engines direct-connected to generators. They have been in almost continuous service for the past 14 years and have performed faithfully under the most exacting demands. In view of the fact that the engines furnish only a part of the power, the balance being purchased, the load is nearly always up to the rated capacity of the engines, which are operated for many weeks without a shutdown for inspection. These are made by the Fulton Iron Works, are of the air injection type, and A-frame construction, a characteristic of the earlier Diesel engine construction. The engines have consistently maintained their economy, which is well in keeping with the usual Diesel experience. The general view of the engine room and engines is shown in Fig. 7.

Best Bros. Keene's Cement Co.

A unique installation of McIntosh and Seymour Diesels is found at Best Bros. Keene's Cement Co. plant at Medicine Lodge, Kan., another plant with more than 40 years' history, whose founders saw much of the covered wagon days and whose business contributed no little to the growth of the Southwest. In addition to the McIntosh and Seymour Diesels for the power plant proper, a Fairbanks-Morse engine rated at 210 hp. is used at the quarry power house of this company, located 25 miles from the main plant at Sun City, Kan. In Fig. 8 is shown the power house. These engines have been in operation for some time, and the company's president, John Best, gave the writer the following figures on the operating conditions and the cost in this plant.

While this plant is a small one in horsepower, comprising two 338-hp. air injection engines, and operates at a very low load fac-

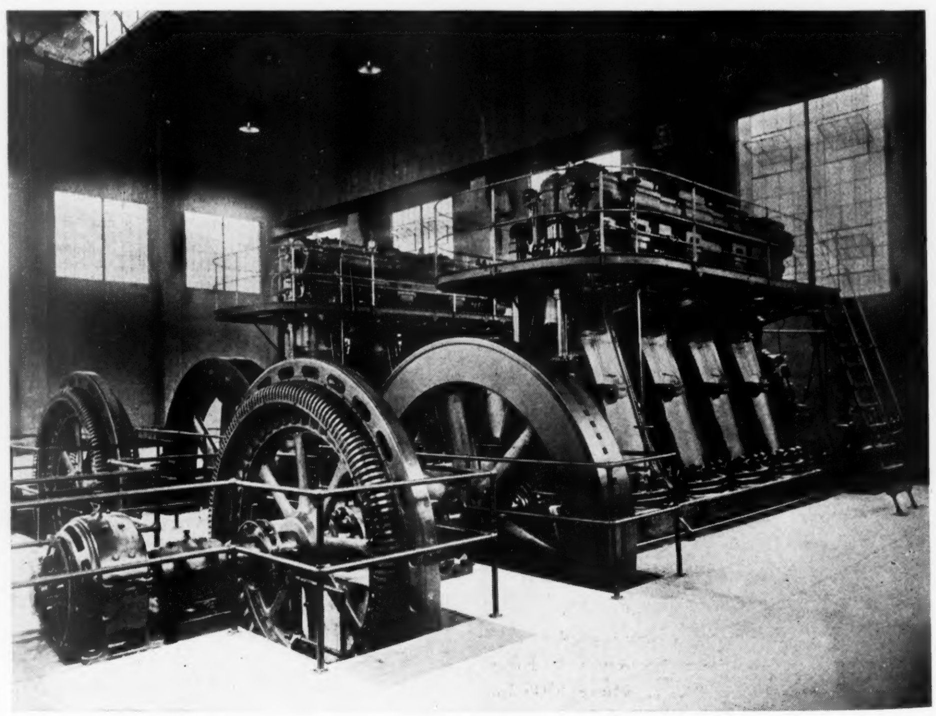


Fig. 7. Two 530 hp. Diesel engines driving generators in a cement mill; these engines have been in continuous service for the past 14 years

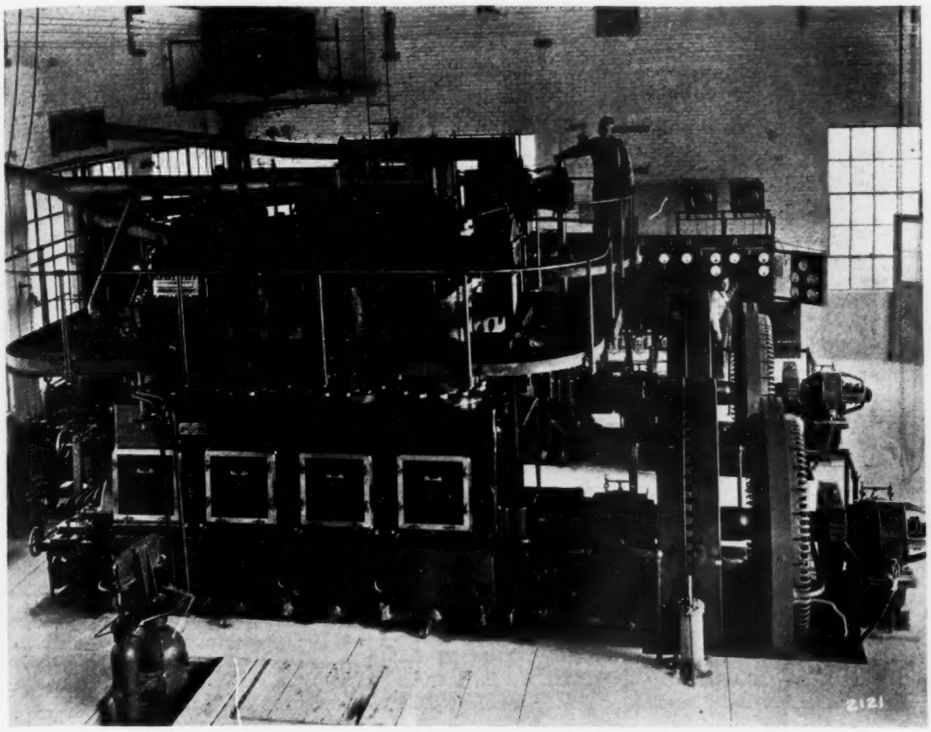


Fig. 8. Two 335-hp. Diesels and another of 110-hp. at the Best Bros. Keene's Cement Co.

tor because of the conditions of operation, it has a very dependable power at an overall cost of 1.32c. for kw.-hr. The following tabulation gives the details:

RECORD OF 11 MONTHS' OPERATION, BEST BROS. KEENE'S CEMENT CO. PLANT

Kw.-hr. generated	536,255
Total engine hours	6,209
Fuel oil consumed, gal.	54,166
Average kw.-hr. per gal.	9.9
Lubricating oil consumption, gal.	900
OPERATING COST	
Fuel oil at 3c. per gal.	$1,624.98
Lubricating oil at 50c.	450.00
Labor for period	4,050.00
Repairs, none but reserved	840.00
Miscellaneous	150.00
	$7,069.98
Cost per kw.-hr.	$0.0132

These engines are direct-connected to 230-kw. generators. The day load varies from about 160 to 170 kw. and a load of something over 40 kw. is carried from 5 p. .m until 7 a. m. It should be noted that the power requirements are less than the capacity of one engine, leaving the other as a spare and standby and as provision for future expansion and growth. Even for the greater part of the day the active unit is under an unfavorable load factor, scarcely 18% for a plant factor and 38% on the basis of one unit. The charge for lubricating oil is high, and it is learned that 400 gal. of it were used in other parts of the mill. In addition to these no charge is credited for the steam generated for heating the building by the use of a waste-heat exchanger utilizing the heat from the engine exhaust.

It should also be observed that the labor charge of $4000 is large for a small plant, this amount being sufficient for a plant of almost any size. This is practically $350 a month for labor, or engineers; the total fuel bill is less than $150 a month, a condition not often found. This is practically $25 per year per kilowatt demand for the year. The low load factor and the low plant factor make this high. In Table II, ROCK PRODUCTS, June 22, p. 55, I showed a labor charge for such plants of $10.65 per horsepower per year, which includes sufficient allowance for salaries and wages of engineers and oilers to take care of the average estimate. This item will show a much less comparative figure when a plant is operated at a higher load and more hours.

The allowance for the repairs was also never spent, and thus further decreases the actual cost of power. Taking all facts into consideration, small size of the plant, low load factor, expense charged to but not incurred by the engines, and benefits not credited, this cost of 1.32c. per kw.-hr. is ridicuously low in comparison with generating costs from any steam-power electric plant of similar size and horsepower. Fuel consumption is practically one-third to one-fifth that in the average steam plant.

An important use was made of the Diesel engine is that of standby service in cement plants otherwise dependent upon purchased electric power. Such an application is found at the Lawrence Portland Cement Co. plant at Thomaston, Maine. Accordingly, the Central Maine Power Co. bought a 360-hp. Fairbanks-Morse plant, Fig. 10-A, so that it could guarantee the cement company absolutely 100% service to the extent of 225 kw. in case of the failure of its high-tension line. In case of outside power failure, the kilns, coolers and slurry pumps are kept in operation.

It has been reported that the summer storms have been a constant source of trouble to the 62 miles of transmission line over which the power comes from the new Gulf Island hydro-electric plant of the Central Maine Power Co., although this line has been constructed with all possible protective devices and is said to be the last word in transmission lines. Nevertheless, the power was off three times in one week and the last time for a four-hour period, and during one month the line failed five times.

Power Fails as Engineers Argue

An interesting story is reported concerning the trouble experienced by a Fairbanks-Morse engineer upon completion of the standby-power unit's erection, in connection with getting an opportunity to make a test run for acceptance by the power company's engineers. The cement plant being in full production, the officials refused to interrupt the schedule of production long enough for the engine maker's engineer to run a test. Argument seems to have lasted about a week, with the cement officials refusing to provide a load for the test run and the power company men refusing to accept the unit without such a test run. It so happened while the cement company's consulting engineer, and the power company's assistant chief engineer, and the Fairbanks-Morse company's engineer were present, standing beside the engine, the line failed. In a few minutes, the kilns, motor-generator set for cranes, slurry-tank

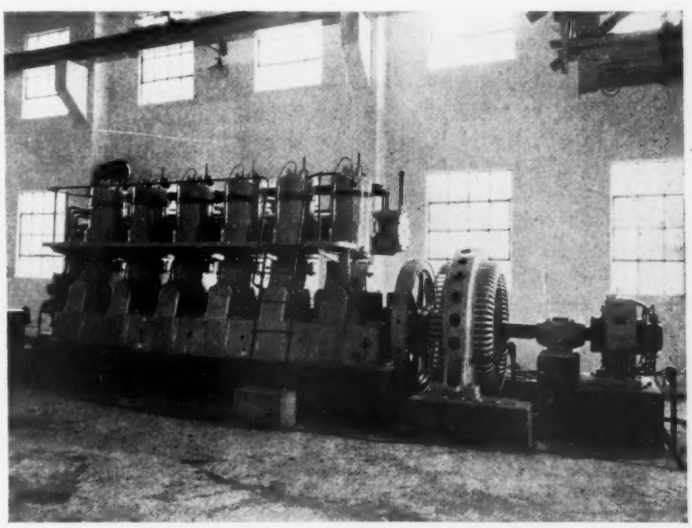


Fig. 10A. Full-Diesel standby engine of 360 hp. for emergency use in case of power failure, Lawrence Portland Cement Co., Thomaston, Me.

agitators and pumps were in operation from the Diesel power. The engine carried the load during the 1½ hours the power was off, and at the end of the run the engine was accepted by both the power company and the cement company.

On one four-hour emergency run the engine carried a heavy overload and maintained production ahead of schedule. This is not to be recommended as a regular practice for any oil engine. Without the Diesel standby service, the damage from lack of power would have been many times the cost of the unit; in other words, it has paid for itself already in the savings of production losses.

Analysis of Diesel Power

The curves in Fig. 11 indicate the average consumption of heat units for different prime movers. The cost per kilowatt-hour for the various prime movers when using fuel at prices available can be closely ascertained by the use of the logarithmic chart, Fig. 12. When price of fuel and the consumption in pounds per brake-horsepower or kilowatt-hour is known, the cost can be ascertained by laying a ruler across three of the lines and reading the cost. The B.t.u. content of the fuel is also taken into consideration, but for the average purpose in Diesel-engine estimating the fuel is assumed at 18,500 B.t.u. per lb. of fuel.

Cost of Diesel Power Plants

Inasmuch as the average cement plant employs from 3000 to 6000 hp., and would require the flexibility of a number of units, from three to eight engines are found in plants of this size. A very exact and detailed account of the cost of such a plant, together with operating costs, overhead and fixed charges, as well as the proper design of such plants, would therefore be worth looking into. When these figures are considered and comparison carefully made with steam power and purchased electricity, the application of Diesels in many cement plants would seem feasible. The following estimate of the complete cost of a 5000-kw. Diesel electric generating plant, consisting of five Diesel engines rated at 1000 kw. each, is thought to be conservative and sufficiently high. These figures represent the experience of the leading Diesel engine builders. The figures are applicable under the most exacting conditions, and would cover the necessary calculations in most cases.

The price given per installed kilowatt-hour for engines and generators only is given at $120 per kw. This is somewhat high in the light of recent Diesel engine sales records, but is sufficiently liberal to meet all conditions. Cooling water equipment includes the necessary cooling towers, an absolute necessity from the standpoint of economy and safety for all Diesel engine plants.

Engineering estimates for the construction of such a plant would agree closely with the totals given for the average typical power

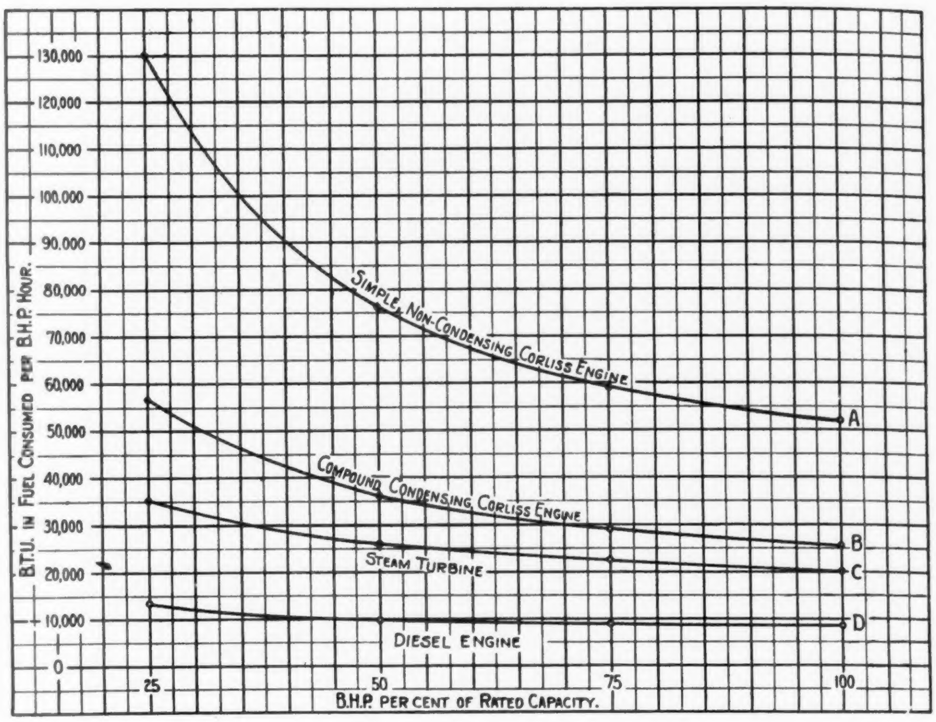


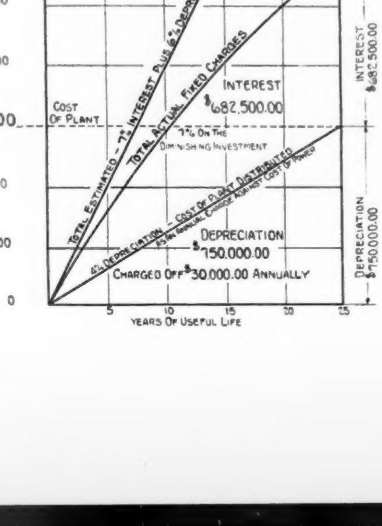
Fig. 11. Comparative thermal efficiency of various prime movers at hp. percentage of rated capacity

plant of this size for the cement plants.

Estimating Fixed Charges

In making an analysis of power costs, the Diesel engine has often been condemned, without a hearing, as guilty of high fixed charges, because of the higher initial costs. When it is considered the life of the engines is anywhere from 15 to 25 years, and that the matter of obsolescence is practically nil, the usual method of placing the Diesel in a bad light in the handling of interest, depreciation and sinking fund accounts is not sound or fair. These figures are usually about 7% interest and 6% depreciation per annum, and are figured on the straight-line

TABLE II. $1,000,000 EXCESS FIXED CHARGES OFTEN ESTIMATED ON A $750,000 DIESEL PLANT



basis without regard to the sinking fund method. In Chart 2, this is clearly shown to

TABLE I. COST OF DIESEL POWER PLANTS

The itemized estimate on a 5000-kw. Diesel electric plant shown below presents approximate costs per kw. of the various items of equipment.

Large plants will cost slightly less and smaller plants will cost slightly more.

	Total	Per kw.
Real estate—Lot 175x200 ft.	$ 2,000	$0.40
Building—Of brick, 112x60x24 ft., including 5-ton crane and 7500-bbl. concrete fuel oil storage	65,000	13.00
Foundations for engines and generators, 1400 cu. yd. at $15	21,000	4.20
Five Diesel engines, each rated 1000 kw.; total weight, including standard auxiliary equipment, about 840 tons; with Five generators, each 1000 kw., 3-phase, 60-cycle, 2300-v., including direct connected exciters; weight about 90 tons, f.o.b. factory	*600,000	120.00
Freight on 930 tons at, say, 75c. per cwt. (engines and generators)	14,000	2.80
Piping—70 ft. of 12-in. exhaust piping per engine, small oil and water piping to connect engines to oil tanks and water supply	8,000	1.60
Cooling water equipment, including tower, motor-driven pumps and piping	10,000	2.00
Erection of machinery, including superintendence, expert and common labor	10,000	2.00
Switchboard—Eight panels, including station wiring, installed	†10,000	2.00
Miscellaneous items and contingencies	‡10,000	2.00
	$750,000	§$150.00

*Latest advice received would place this item of $600,000 at approximately $435,000.

†Modern switchboard and switchgear is somewhat higher and should really be about $20,000 for this size plant.

‡Miscellaneous items would include sufficient incidentals, and to cover cost of special equipment, like air filters, perhaps a centrifuging plant for a modern Diesel generating station, and should be $15,000 instead of $10,000 for this item.

§These same engines today, weight and size would doubtless be rated at around 1150 kw. instead of 1000 kw., due to the tendency to change the rating and increase piston speeds. All of this would bring the price per kw. down to $104, instead of $150.

produce an enormous excess fixed charge.

In 25 years a huge sum of $1,000,000 in excess of fixed charges is built up when both interest and depreciation are figured on the straight-line basis. In addition to the straight-line handling of depreciation, interest is usually figured against the plant for the entire life of the equipment. Actually, if the depreciation is figured on a straight-line basis, the interest charge should at least be reduced as the investment is reduced. The average interest then would be about half the original interest as shown in the table. In this case it is actually 4%, or $30,000 a year. The actual interest on the original investment, diminished each year by charging off depreciation of 4%, is found from the formula:

$$\text{Average interest on investment} = \frac{\text{Interest rate} \times (\text{yrs.} + 1)}{25 \times 2}$$

$$\text{Average rate} = \frac{0.07\,(25 + 1)}{25 \times 2} = 3.64\%$$

And an annual interest charge of 3.64% on $750,000 is $27,300. This makes the charge for depreciation of $30,000 plus the $27,300 per year only $1,432,500 in 25 years, instead of $2,437,500, or more than $1,000,000 in excess.

This trick is so frequently resorted to in order to condemn the Diesel that it is recommended to engineers and all those interested in the Diesel engines that this analysis be studied.

Inasmuch as a great many Diesel engines have now been in use for 20 to 25 years, and the real repair costs, depreciation and the like are known, there no longer remains this argument against it. Most of these early engines, which were crudely constructed and poorly designed, are still in use, and producing power substantially as cheap as when first installed.

In connection with interest and depreciation, the following table shows the percentage which must be set aside to cover depreciation or the cost of the equipment over the period of years selected as the useful life of the machinery. This is a sinking fund method, compounded semi-annually.

TABLE II. SINKING FUND EXPRESSED—AS A PERCENTAGE OF FIRST COST

Life in years	Rate of compound interest, % 5	6	7
15 years	4.63	4.30	3.97
20 years	3.82	2.72	2.44
25 years	2.10	1.82	1.58

In most good practice today the total fixed charges are 6% interest on the investment, depreciation 2.72%, taxes 1.5% and insurance 1.5%, or a total of 11.72%.

Profits Write Off Investment

There is still a simpler method of considering the depreciation item, and that is to ignore it entirely. This means to consider the savings over and above the operating cost, taxes and insurance as paying for the engine. This requires only a few years in most cases. The plant is paid for entirely out of the savings. The investment is written off as totally depreciated. There are no fixed charges. Only the operating and repair costs thereafter are to be considered. In this light, Diesel engines are profitable and very profitable under continuous load for cement plants, where the difference in the cost of current and the operating cost of the engines would write the investment entirely off the books in from three to five years.

Operating Costs, 5000-kw. Plant

Carrying this analysis through still farther and calculating the actual operating cost at the various load factors, it becomes very clear how a Diesel plant pays for itself in the course of a few years. In the Table IV is a typical operating expense of a 5000-kw. plant at 40%, 60% and 80% load factors. It will be noted that fixed charges have been carefully figured and the total overall, or complete, costs are in all cases given. There is nothing to add to this. The estimate should satisfy the most exacting and conservative engineers who would attempt application of Diesel power to cement plants. The total costs, ranging from 1¼c. down to approximately 0.8c. per kw.-hr., are worth con-

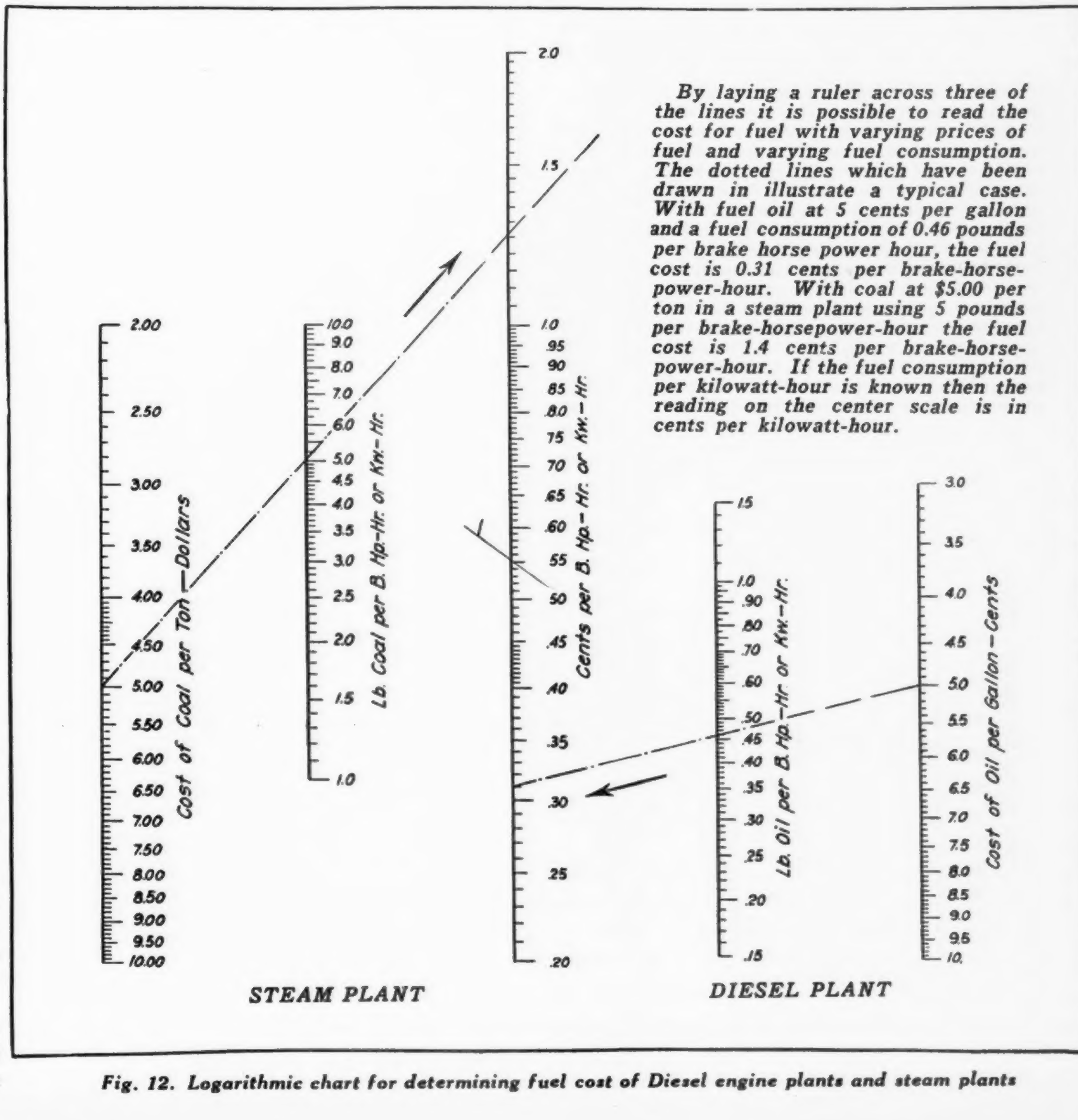


Fig. 12. Logarithmic chart for determining fuel cost of Diesel engine plants and steam plants

sidering for load factors from 40% to 80%, including fixed charges.

TABLE IV. TYPICAL OPERATING EXPENSE; 5000-KW. DIESEL ELECTRIC PLANT—40%, 60% AND 80% LOAD FACTOR

Fixed Expenses:		
Interest and depreciation	$57,300	
Taxes and insurance—2%	15,000	$72,300
Labor:		
1 chief engineer	3,600	
3 assistant engineers at $175	6,300	
3 operating engineers at $140	5,040	
		14,940
Maintenance—1½%		11,250
Total fixed expense per annum		$98,490
Variable Expense:		
Lubrication—1 gal. per 2000 kw.-hr. at 65c per gal. per kw.-hr., 0.0325c.		
Fuel—10.7 kw.-hr. per gal., 450 kw.-hr. per bbl. at $2 per bbl.; cost per kw.-hr., 0.4440c.		
At 40% Load Factor—Annual output, 17,520,000 kw.-hr.		
Fixed expense		$98.490
Lubrication		5,700
Fuel, at $2 per bbl		77,865
Total power cost with $2 fuel		$182,055
Total cost per kw.-hr., 1.040c.		
At 60% Load Factor—Annual output, 26,280,000 kw.-hr.		
Fixed expense		$98,490
Lubrication		8,550
Fuel, at $2 per bbl		116,800
Total power cost with $2 fuel		$223,840
Total cost per kw.-hr., 0.852c.		
At 80% Load Factor—Annual output, 35,040,000 kw.-hr.		
Fixed expense		$98,490
Lubrication		11,400
Fuel, at $2 per bbl		155,730
Total cost with $2 fuel		$265,620
Total cost per kw.-hr., 0.758c.		

Labor Required in Plants

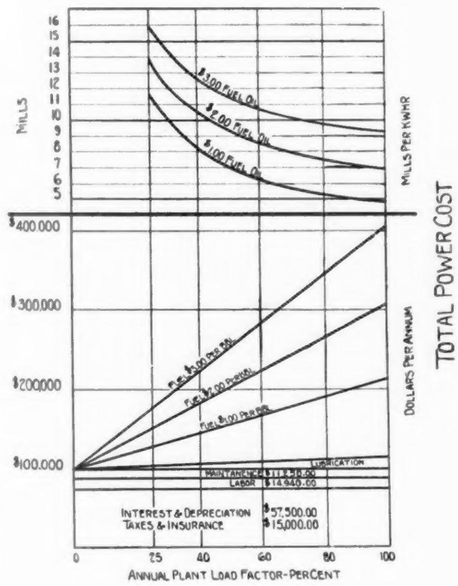
The labor cost herein allowed is amply high to secure the best possible operating force. I do not think in many observations at a great number of plants of this size that any such cost exists in actual practice. The force is also amply large. One chief engineer and three assistant engineers assisted further by three operating engineers is considered the actual crew necessary for handling a plant 24 hours a day. In nearly all cases fewer men were actually employed.

It should also be noted that better than $2 per installed kilowatt is allowed per year for maintenance, an additional allowance rarely spent in such plants, for repairs, and skilled engineers from the factory. These plants have in service operated many years without assistance from the manufacturer that incurred any considerable expense, and with a very modest repair costs. Unless crankshafts are allowed to break, or such similar major disasters, no such repair costs have been observed in the average plant.

Cost and Supply of Fuel Oil

The cost of fuel oil and the variation in price does not seriously affect the total price per kilowatt-hour. This is clearly shown in Chart 3, for a 5000-kw. installation. Variations of 1c. per gal. in the price of fuel means less than than 0.1c. per kw.-hr. And 0.1c. does not show up the practical figures. While Chart 3 shows the cost in dollars per year and mills per kilowatt-hour for fuel price variation for the operation of such a plant, Chart 4 indicates that for some years now the variation has not been serious, not nearly so much as coal during strikes, or like periods. This chart was compiled by the Federal Oil Conservation Board and is reliable. While this was made in 1925, the variation since that time has actually been less and the trend downward. The supply of fuel available is considered unlimited for practical purposes. In addition to the byproducts of petroleum, Diesel engines are successfully operating in the Southern States on coal-tar distillates. Experiments looking toward the successful use of such a product from the unlimited Texas lignite are now under way, and while little information is available, it is expected that such fuel will some day be utilized for Diesel motor fuels. The best research available on the probable availability and supply of Diesel fuels shows there is little occasion for concern or alarm on this point.

TABLE V. COST OF DIESEL POWER; INSTALLED CAPACITY 5000 Kw.



Plants Are Carefully Planned

The Diesel power plants found in cement mills show careful planning. In most mases adequate care has been given to the layout of all that goes to make the plant adapted to the special use for which it is intended.

While the Diesel plant is practically a self-contained plant, the necessary auxiliaries and equipment needed to reduce the amount of supervision and attendance usually required are used. The result is that the duties of the attendants have been reduced to routine matters, in connection with supplying lubricating oil, cooling water, and fuel. About the usual work there is little other than stopping and starting the engines, keeping them clean and attending to the operation of fuel and lubricating oil pumps, etc.

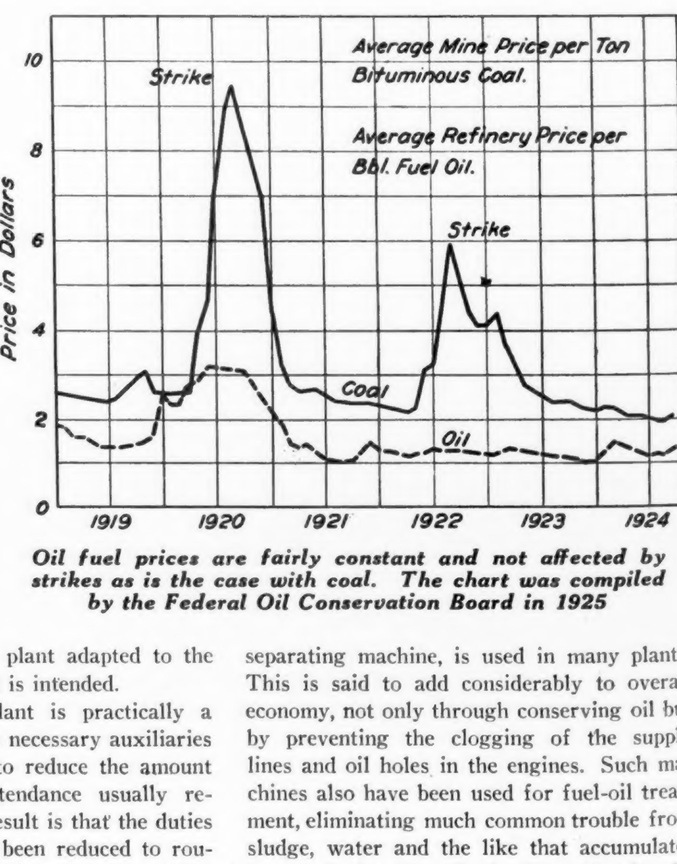
In most of these plants exhaust indicating pyrometers are employed for measuring the temperature of each cylinder, and for maintaining proper load balance. General improved operation and lower maintenance have been attributed to the careful watch which the pyrometer makes possible over the operation of larger multi-cylinder engines.

The utilization of waste heat from the exhaust and recovery of heat from cooling water by the use of a heat exchanger, or in connection with heating boilers, has further contributed to the economy of Diesels in cement plants. At the San Antonio Portland Cement Co. plant Brown pyrometers are used throughout, and it is said that the plant could not operate with the present high efficiency without the use of this important instrument.

Lubrication

Most of the plants employ duplicate pumping systems in connection with force or pressure lubricating systems, which make them thoroughly dependable and require but little supervision. In some cases alarms to guard against leakage and breaks in the pipe lines are used to further insure safety. Low pressure alarms are also used.

Centrifuging, or a system of reclaiming the used lubricant and recirculating it through the engines by means of a centrifuging or separating machine, is used in many plants. This is said to add considerably to overall economy, not only through conserving oil but by preventing the clogging of the supply lines and oil holes in the engines. Such machines also have been used for fuel-oil treatment, eliminating much common trouble from sludge, water and the like that accumulates in the fuel tanks. Fuel oil purification by



Oil fuel prices are fairly constant and not affected by strikes as is the case with coal. The chart was compiled by the Federal Oil Conservation Board in 1925

mechanical means is coming into general practice in well-designed Diesel plants, a method which not only reduces the possibilities of shutdown due to clogged fuel lines, but prevents wear on the injection valves by the usual grit, which is taken out of the fuel. Fuel-oil filters are also used.

Cooling Water Treatment

While not all of the plants have given the matter of cooling water treatment attention, in some cases this has been absolutely necessary to prevent scale formation in the jackets. The deposit of scale in plants not using treated water has to be watched closely. In one plant the scale is cleaned at frequent intervals, and from experience it is known just how often this is required. It is said that this procedure is cheaper than the cost of providing water-treatment apparatus.

Spray ponds and cooling towers are generally used to recirculate the water. It is, however, observed in many cases that the accumulating scale is more rapid than if the water was pumped from the wells and allowed to waste. Pumping the water over towers or ponds is usually more economical than pumping continuously from wells and wasting, due to the difference in power required for the operation, this being the only consideration where such wells exist. The available supply of water used in cement plants employing the wet process is usually drawn from for make-up water for the Diesel engine cooling system.

Such large supplies of water are usually very deep wells, and this water in almost every case is of prohibitive hardness, and should really be treated before being added to the cooling system.

While duplicate sets of water-circulating pumps are always employed to insure additional, overhead storage tanks are also used as further insurance of the water supply, which emergency would occur in case of trouble with the power lines, or the necessity of shutting off the current at the board, which occurs in case of accident. At such times the engines would have to be shut down, or a gravity tank would be necessary for continued flow to meet emergency.

Exhaust silencing is practiced in plants desiring quick exhaust, and the use of the silencer of the Maxim type is employed. Usually, however, the engines are not noisy when the exhaust goes to a pit and then to the exhaust stock. For two-cycle engines, however, where the exhaust must be carefully handled, undue restriction is not possible, and therefore the use of silencers are resorted to if necessary to reduce the exhaust noise to a minimum.

Fig. 13. Engine room and switchboard showing the pyrometer installation at the San Antonio Portland Cement Co.

The electrical system, comprising switchgear, generator and exciters, shows practically the best up-to-date engineering. Direct-connected exciters, as well as motor generator sets for exciting the alternators, are used practically universally. These are usually of the Westinghouse or General Electric type, of standard design and construction. Direct current is employed in some of the plants, possibly decided upon to prevent the junking of d.-c. motors which were quite common in years past. The flexibility of direct-current drives were preferred in some plants also, and found very efficient, although the maintenance is possibly higher.

Ample storage for fuel oil is usually provided, consisting in most cases of a large underground tank of concrete construction, reinforced and circular. Low grades of crude oil and distillates are used, with provision of preheating in some cases when the temperature is low. Some of the plants enjoy a source of very low-priced fuel, bought in large quantities at advantageous times. Economies have been thus effected by having the facilities for storage of several months' or a year's supply of fuel.

A supply of repair parts, consisting of heads, cylinders, fuel pump parts, cylinder liners and other necessary spare parts, is usually kept on hand to meet the necessity immediately it occurs. Shut-downs for any length of time are rare, and satisfactory repair work is learned and practiced by the engineers and operators. Ample shop equipment for doing this work is provided in a great many cases. The specialized work of maintaining a steady and dependable flow of power has been quite thoroughly organized and developed at these larger plants.

Broken crankshafts have been rare, but such repairs of this major nature have been made locally at some of the plants.

Periodic shut-downs for inspection and seasonal repair and overhaul are practiced with due consideration to the requirements of the engines, and wherever sufficient power is available such work isn't postponed too long. In all plants where major breakdowns were recorded, these were cases where there wasn't sufficient power or where attempted overloading was resorted to in an emergency,

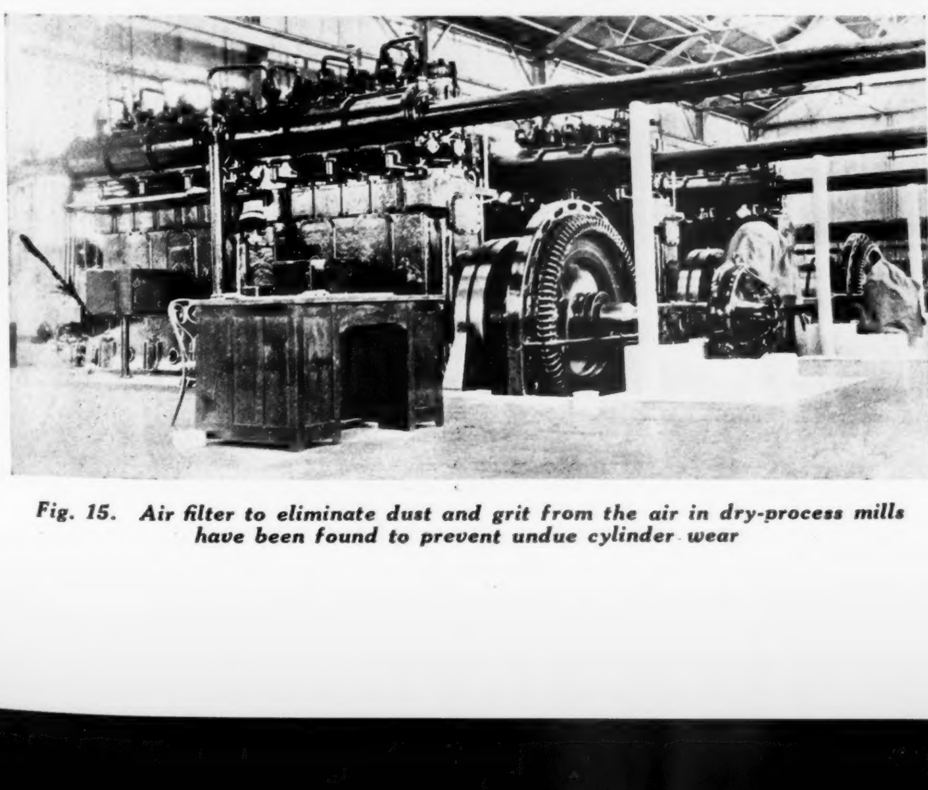


Fig. 15. Air filter to eliminate dust and grit from the air in dry-process mills have been found to prevent undue cylinder wear

or where only a part of the load was carried on the Diesels. In these cases experience demonstrated that such practice was ill-advised and consequently abandoned after the first trouble occurred.

Air filters for eliminating the dust and grit that contaminates the air around plants

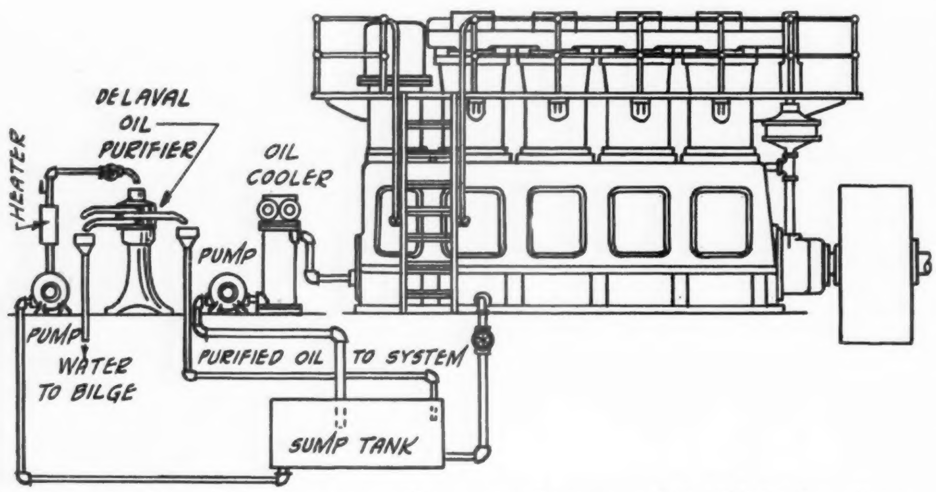


Fig. 16. Oil purifying system used at many plants to reclaim lubricating oil or to clean the fuel oil

using the dry process of portland cement manufacture is thought to be necessary for preventing undue cylinder wear. Such a filter is shown in an accompanying cut.

The standard equipment and special auxiliary apparatus required for the successful handling of the engine is found to be pretty well complete in all of the larger plants.

Good engineering has been used in the design and construction of the power-plant buildings, cooling towers and ponds, fuel-oil storage, water and oil supply systems. More care is being given to the selection of the proper kind of lubricating oil and its handling.

Conclusions

Proper study of the foregoing furnishes evidence that many cement plants may generate their own power economically. This is particularly true where the kilns are fired with oil, a cheap supply for the engines, which could in most cases use the same fuel assumed.

While most of the plants in the Southwest use natural gas for burning, they formerly used oil, and are and should be prepared to change over from natural gas to oil in a short time or on short notice. This is the case when gas mains have to be shut off for emergencies or other reasons. They either do or should keep on hand a standby reserve of oil for use when the gas fails. Such plants could and some of them do, as a result, go ahead and continue to utilize their own Diesel-generated power.

The abundance of petroleum and natural gas contributes to the economy of operation of many cement mills throughout the South and Southwestern States, and the number of new plants just completed or nearing completion is evidence of the expected growth of this industry in that section of the country. The Western States show a like enterprise in the construction of new cement plants.

In view of the extreme necessity for a reliable and continuous flow of power, and a reliable source of supply of fuel, doubtless the burning of petroleum in the kilns and as fuel for Diesel electric generating plants for these applications will in the future increase both in importance and necessity.

The chance of the failure in the supply of natural gas, as well as electric current, particularly adjacent to the larger cities, that is, outages and interruptions, has been observed and found a matter of no little amount of trouble to the cement plants so dependent upon these two sources alone.

The use of Diesel engines, either as a full power plant or for part of the load and acting as a standby unit, is suggested by the example of plants that are making such use of this prime mover. Increased reliability and dependability of the operation would be assured. Doubtless when properly worked out and organized, such a combination would result in lower cost of production. This in itself constitutes a worthy subject of investigation and study and is doubtless suggestive of a further market for Diesel engines.

In the concluding article of this series will be discussed the most important and far-reaching influence of the Diesel engine, namely, the application of the high-speed, mobile type Diesel in such portable applications as shovels, draglines, locomotives, portable air compressors, drilling rigs, and the like in the rock products industries. It will be shown how this type of engine is destined to supplant, practically if not completely, in such application the gasoline engines heretofore used.

Bentonite in Southern Arkansas

RECENTLY three bentonite deposits have been identified in the coastal plain region of southern Arkansas; these are in relatively similar strategraphic deposits and suggest that there may be large quantities of this material in a zone following roughly a line connecting them with the thicker deposits to the northeast. The material is accessible, easily mined and may be of future importance, says G. C. Branner in a recent paper (No. 239) delivered at the New York meeting of the A. I. M. E.

The extent of the Saline county deposit and that in Hot Springs county has not been determined definitely. The thickness of the Ouactula county deposit varies between 12 and 18 in.

Car Cleaning and Repairing Costs

THE report of the joint committee representing the three mineral aggregate associations on the cost of cleaning and repairing railroad cars has been recently released and is available in its complete form to members of the three associations. An abstract of this report, giving pertinent details and cost figures, was published in Rock Products, September 28, 1929.

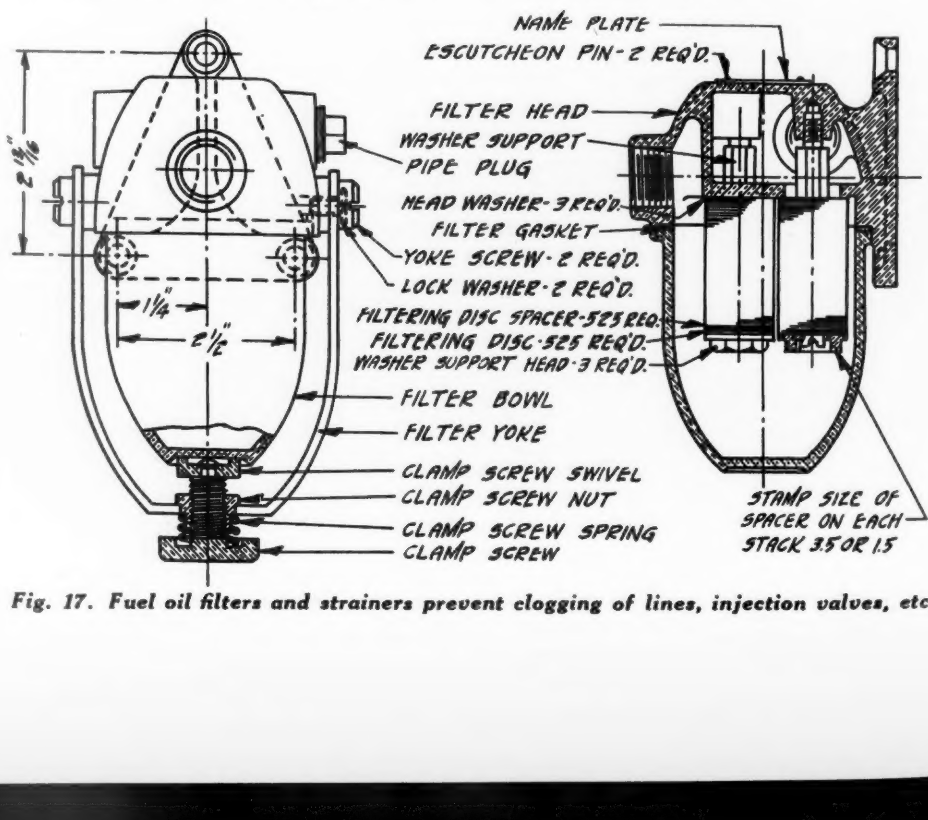


Fig. 17. Fuel oil filters and strainers prevent clogging of lines, injection valves, etc.

Absorption and Strength of Commercial Sand-Lime Brick*

By H. F. McMurdie

NUMEROUS measurements of the absorption and the strengths of sand-lime brick have been made in various laboratories. A large part of these tests, however, was made on small lots, and the results therefore have not been as representative as needed for more critical studies. It was considered desirable to have tests made on a large number of samples from various producers in order to obtain data on water absorption and on transverse and compressive strengths, and to discover any relations between these properties which might exist.

Source and Description of Samples

Lots of about 50 brick each, representing regular production, were obtained from 25 different producers. These producers were located as follows: Eight in Michigan, three in New York, two each in Wisconsin and New Jersey, and one each in Pennsylvania, Florida, Indiana, Louisiana, South Dakota, Utah, Ohio, Massachusetts, Georgia, and the District of Columbia. Table I contains a brief description of the bricks used.

Methods of Testing

The brick as received were dried to constant weight in a gas-fired oven at a temperature ranging from 110 deg. to 140 deg C. They were then cooled, weighed and totally immersed edgewise in about six inches of water at room temperature. They were removed at the end of definite intervals of time, wiped with a damp cloth and weighed. These intervals of time were 5 minutes, 5 hours and 24 hours. The bricks were then placed in a copper boiler, covered with water, and boiled for 5 hours. The water and bricks were allowed to cool over night, after which the bricks were removed from the water, wiped with a damp cloth and weighed

The specimens were then again dried to constant weight. Ten bricks from each lot were reserved for future tests. The remaining bricks were broken transversely, the tests being made on a 2000-lb. capacity machine in accordance with the Tentative Methods of Testing Brick.[1] All paneled bricks were broken with the panel upwards in the transverse test.

Of the paneled brick, Nos. 16, 16a, and 20 had the panels filled with neat portland cement mortar before the transverse test, and Nos. 2, 2a, 7 and 18 had the necessary correction for the panel applied to the formula for calculation of modulus of rupture. The panels of these last four bricks were filled with neat portland cement mortar after the transverse tests in preparation for the subsequent compressive tests.

MEASUREMENTS of absorption and of transverse and compressive strengths have been made on brick obtained from 25 different commercial producers of sand-lime brick. The maximum, minimum, average, and distribution of the values obtained and the relations between the various factors are recorded.

The half bricks from the transverse tests were used for the compressive tests, one-half of each brick being tested flat and the other half on edge. Before the compressive tests were made the half bricks were faced with plaster of paris by pouring a thin layer of the plaster on a glass plate and pressing the moistened bricks into the plaster. After the plaster had set, the bricks were removed from the plate and stored on shelves in the laboratory until weighing at 24-hour intervals indicated that the weight was constant within the accuracy of the balance (1 gram). They were then tested in compression on a 100,000-lb. capacity machine in accordance with the recommended procedure of the

[1]American Society for Testing Materials, Tentative Standards, 1927, page 269.

*Publication approved by the director of the National Bureau of Standards of the United States Department of Commerce.

TABLE 2. INDIVIDUAL ABSORPTION VALUES FOR BRICK No. 22
(Percentage of dry weight)

Spec. No.	Wt. in gr. (per 1100 cu.cm.)	5 min.	5 hr.	24 hr.	5 hr. boil
Spec. No.	Wt. in gr. (per 1100 cu.cm.)	5 min.	5 hr.	24 hr.	5 hr. boil
38	2020	3.2	11.1	11.6	14.6
46	1965	4.3	12.8	12.8	14.8
27	1980	3.8	12.1	12.6	15.9
39	1975	5.1	11.2	12.6	15.9
44	2020	3.2	11.8	12,6	16.1
36	2010	3.5	11.9	12.4	16.1
34	1890	2.4	13.5	13.7	16.4
18	2010	3.2	11.2	11.7	16.6
11	2030	3.0	10.8	11.6	16.7
48	1945	3.6	12.3	13.1	16.7
7	1920	3.4	13.2	13.8	16.9
40	1990	3.8	11.3	12.6	17.0
19	1985	3.8	11.6	12.6	17.1
50	1950	3.9	12.3	12.5	17.2
41	1875	4.5	13.3	13.8	17.3
2	1930	3.6	11.6	12.7	17.3
42	1955	3.8	11.8	13.0	17.4
45	2010	3.5	11.9	12.7	17.4
32	1955	4.1	12.5	13.8	17.4
21	1950	4.1	11.3	12.5	17.4
3	2060	2.9	11.2	11.9	17.5
43	1905	3.9	11.8	13.7	17.6
30	1950	4.6	13.8	13.8	17.7
14	1950	4.6	13.3	13.3	17.7
1	1875	3.5	11.9	12.6	17.9
16	1950	3.3	12.1	12.8	17.9
33	1880	6.6	12.2	13.0	18.1
10	1895	4.5	13.4	13.7	18.1
8	1975	4.1	11.9	12.7	18.2
23	1935	3.9	11.6	11.9	18.3
47	1875	4.8	13.8	13.8	18.4
13	1960	3.1	10.7	13.0	18.4
31	1875	5.1	12.8	14.4	18.6
49	1955	5.1	11.8	14.6	18.7
35	1835	6.0	14.4	14.9	18.8
9	1925	4.2	12.7	13.5	18.9
20	1955	4.3	11.0	12.0	18.9
22	1895	4.0	12.4	13.2	19.0
24	1895	5.0	13.4	13.7	19.0
37	1805	5.5	14.4	14.4	19.1
29	1895	4.8	14.2	15.3	19.2
17	1845	5.1	14.3	14.6	20.0
26	1860	6.0	14.5	15.0	20.2
6	1850	5.9	13.8	14.3	20.2
4	1820	4.7	13.4	13.4	20.3
25	1855	5.4	13.5	14.3	20.7
28	1790	8.1	15.6	15.6	21.2
12	1770	5.9	14.1	14.4	21.4
5	1870	4.6	14.4	15.2	21.6
15	1750	6.0	15.4	15.4	22.2

TABLE 1. DESCRIPTION OF BRICKS

Brick No.	Size in inches	Size of panel in inches	Color	Texture	Remarks
1	8½x4⅛x2⅜	....	White	Coarse	Contained stones up to 1½ in.
2	8 x3¾x2¼	5x1½x ⅛	Red	Fine	Contained red stone up to ¼ in.
*2a	8 x3¾x2¼	5x1½x ⅛	Light red	Fine	
3	8 x3¾x2⅜	....	White	Coarse	Very loose and crumbly. Varied ¼ in. in depth
4	8 x3¾x2¼	....	Yellow grey	Coarse	Surface rough
5	8 x3¾x2¼	....	Yellow grey	Coarse	Surface rough
6	8 x3¾x2¼	....	Grey	Fine	Contained nodules of lime
7	8¼x3¾x2¼	6x1½x ⅜	White	Medium	Varied ¼ in. in depth
8	8 x3⅝x2¼	....	Grey	Medium	Contained stones up to ¼ in.
9	8 x3¾x2¼	....	Yellow grey	Medium	Contained stones up to ¼ in.
10	8¼x4 x2½	....	White	Coarse	
11	8 x3¾x2¼	....	Grey	Medium	
12	8 x3¾x2¼	....	Yellow grey	Coarse	Surface rough. Laminated obliquely
13	8¼x4 x2⅜	....	Light red	Coarse	Contained cinders and nodules of lime
14	8 x3¾x2½	....	Grey	Fine	Contained stones up to ¼ in.
15	8 x3¾x2½	....	Light brown	Medium	
16	8 x3¾x2½	Oval 5x2x¼	White	Coarse	
†16a	8 x3¾x2½	Oval 5x2x¼	White	Coarse	
17	8 x3¾x2¼	....	White	Medium	
18	8 x3¾x2¼	6x1½x ⅜	White	Fine	Contained nodules of lime
19	8¼x3¾x2¼	....	Grey	Medium	
20	8 x3⅝x2¼	4x1½x ¼	White	Coarse	
21	8 x3¾x2½	....	Light brown	Medium	Covered with loose lime
22	8 x3¾x2¼	....	White	Medium	Contained nodules of lime
23	8 x3¾x2¼	....	White	Medium	Pressure face rough
24	8 x3¾x2¼	....	Grey	Medium	
25	8 x3¾x2¼	....	Light brown	Medium	Contained nodules of lime

*Brick No. 2a was made by the manufacturer of Brick No. 2, using a different sand.
†Brick No. 16a was made by the manufacturer of Brick No. 16, using a different lime.

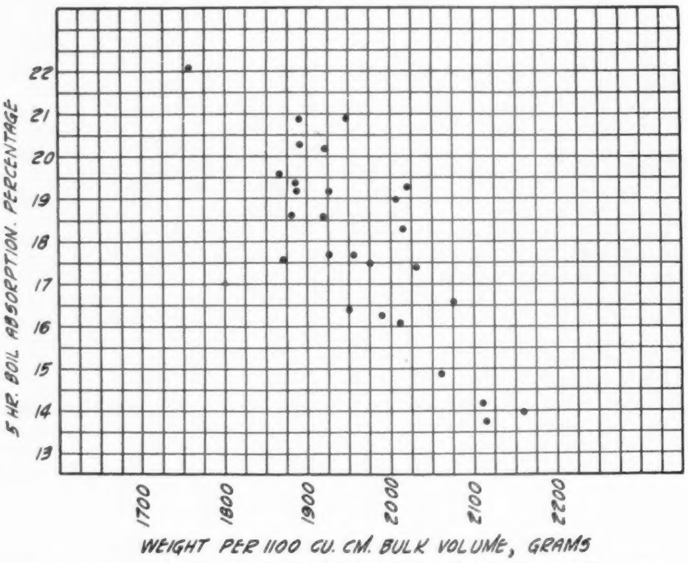


Fig. 1. Relation of individual 5-hour boil absorptions to individual weights of brick No. 22

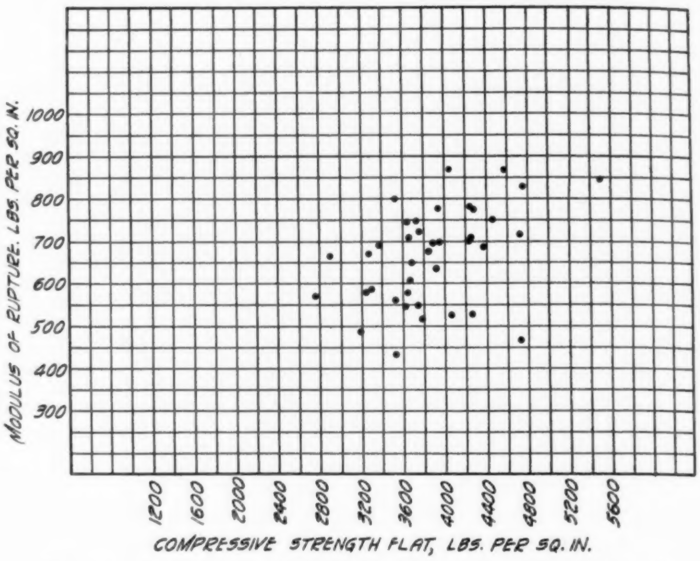


Fig. 2. Relation of individual moduli of rupture to individual compressive strengths, flat, of brick No. 22

American Society for Testing Materials, mentioned above.

Results

1. Individual Brick of One Manufacturer

(a) *Absorption*

Table 2 contains the absorption values for the individual specimens of Brick No. 22,

TABLE 3. RATIOS BETWEEN THE VARIOUS ABSORPTIONS OF INDIVIDUAL SPECIMENS FROM BRICK No. 22

Specimen No.	5 min. cold to 5 hr. cold	5 min. cold to 24 hr. cold	5 min.. cold to 5 hr. boil	5 hr. cold to 24 hr. cold	5 hr. cold to 5 hr. boil	24 hr. cold to 5 hr. boil
38	.29	.28	.22	.96	.76	.80
46	.34	.34	.29	1.00	.86	.86
27	.31	.30	.24	.96	.76	.79
39	.46	.40	.32	.89	.70	.79
44	.27	.25	.20	.94	.73	.78
36	.29	.28	.22	.96	.74	.77
34	.18	.17	.15	.99	.82	.84
18	.29	.27	.19	.96	.68	.70
11	.28	.26	.18	.92	.64	.70
48	.29	.27	.22	.94	.74	.78
7	.26	.25	.20	.96	.78	.82
40	.34	.30	.22	.90	.67	.74
19	.33	.30	.22	.92	.68	.74
50	.32	.31	.23	.98	.72	.73
41	.34	.33	.26	.97	.77	.80
2	.31	.28	.21	.91	.67	.74
42	.32	.29	.22	.91	.68	.75
45	.29	.28	.20	.94	.68	.73
32	.33	.30	.24	.91	.72	.79
21	.36	.33	.24	.90	.65	.72
3	.26	.24	.17	.94	.64	.68
43	.33	.28	.22	.81	.67	.78
30	.33	.33	.26	1.00	.78	.78
14	.35	.35	.26	1.00	.75	.75
1	.29	.28	.20	.95	.67	.70
16	.27	.26	.18	.95	.68	.72
33	.54	.51	.36	.94	.67	.72
10	.34	.33	.25	.98	.74	.76
8	.34	.32	.23	.94	.65	.70
23	.34	.33	.21	.98	.63	.65
47	.35	.35	.26	1.00	.75	.75
13	.29	.24	.17	.82	.58	.71
31	.40	.35	.27	.89	.69	.77
49	.43	.35	.27	.81	.63	.78
35	.42	.40	.32	.97	.77	.79
9	.33	.31	.22	.94	.67	.71
20	.39	.36	.29	.92	.58	.63
22	.34	.32	.22	.94	.65	.70
24	.37	.36	.26	.98	.71	.72
37	.38	.38	.29	1.00	.75	.75
29	.34	.31	.25	.93	.74	.80
17	.36	.35	.25	.98	.72	.73
26	.43	.41	.31	.97	.72	.74
6	.43	.41	.29	.97	.68	.71
4	.35	.35	.23	1.00	.66	.66
25	.40	.38	.26	.95	.65	.69
28	.52	.52	.38	1.00	.74	.74
12	.42	.41	.28	.98	.66	.67
5	.33	.31	.22	.95	.67	.70
15	.39	.39	.27	1.00	.69	.69

arranged in order of increasing five-hour boiling absorptions. The second column gives the weight referred to a brick of standard size, in the present case, the actual weight of the brick. It is seen that the bricks which absorb relatively more water during five hours of boiling usually have the higher absorptions after five minutes' total immersion at normal room temperature. This relation is also shown in Table 3, which gives the ratios between the various absorptions for these same specimens. This table, arranged in order of increasing five-hour boiling absorptions, also shows that those brick absorbing more water after five hours of boiling tend to have a larger percentage of this absorption completed in five minutes.

In Fig. 1 the weight for 1100 cu. cm. bulk volume is plotted against the absorption after five hours of boiling. An approximate relation is apparent. This is typical of other data obtained from the products of other manufacturers.

Table 4 gives the individual strength values for a typical brick (No. 22). In Figs. 2, 3 and 4 these values are plotted. No apparent relationships exist. This fact may be accounted for largely by lack of homegeneity in the test specimens. The presence of stones near the middle of a brick will cause

TABLE 4. INDIVIDUAL STRENGTH VALUES FOR BRICK No. 22
(Lb. per sq. in.)

Spec. No.	5 hr. boil absorption	Modulus of rupture	Comp. flat	Comp. edge
27	15.9	493	3630	2900
39	15.9	638	3370	2720
44	16.1	527	3260	2770
36	16.1	416	4750	3150
34	16.4	692	3650	2940
18	16.6	582	3920	2940
11	16.7	798	5520	3910
48	16.7	554	3680	2510
40	17.0	815	4060	3480
19	17.1	654	4250	2760
50	17.2	748	3510	3290
41	17.3	615	3270	2910
2	17.3	665	4730	3770
42	17.4	432	3200	2560
45	17.4	493	3750	2140
32	17.4	504	3540	3040
3	17.5	615	3590	2950
30	17.7	471	4660	3090
14	17.7	815	4580	3610
16	17.9	698	4470	3220
33	18.1	668	3650	2940
10	18.1	648	4220	3450
8	18.2	521	3620	3070
23	18.3	776	4780	3280
47	18.4	692	3730	2880
13	18.4	632	4390	2330
31	18.6	476	4280	3630
49	18.7	626	3850	3050
35	18.8	516	2780	1990
9	18.9	609	2900	3640
20	18.9	726	3950	2720
22	19.0	670	3760	3190
24	19.0	726	4270	3280
29	19.2	460	3770	2540
17	20.0	382	3510	2740
26	20.2	532	3300	2810
6	20.2	720	4280	3230
4	20.3	643	3890	2050
25	20.7	647	3970	3200
12	21.4	598	3690	2540

TABLE 5. WATER ABSORPTION OF BRICKS
(Percentage of dry weight)

Brick No.	Ave. dry wt. in g. per 1100 cu.cm.	5 min. Max.	5 min. Min.	5 min. Ave.	5 hr. Max.	5 hr. Min.	5 hr. Ave.	24 hr. Max.	24 hr. Min.	24 hr. Ave.	5 hr. boil Max.	5 hr. boil Min.	5 hr. boil Ave.
1	2015	......	......	......	18.0	11.1	14.7	18.2	12.7	15.7	22.9	14.0	17.8
2	1950	......	......	......	17.2	9.9	13.5	18.6	12.3	15.3	21.5	12.7	15.9
2a	2115	2.7	1.9	2.2	12.2	8.5	10.1	13.2	9.9	11.5	15.5	12.0	13.3
3	1890	......	......	......	17.9	11.7	15.0	18.4	12.1	15.5	21.9	15.5	19.8
4	1990	13.1	3.3	6.2	14.4	8.8	11.0	14.9	9.5	11.8	20.0	12.0	15.8
5	2010	7.6	4.4	5.9	12.0	10.5	11.1	12.4	10.7	11.4	17.5	13.5	15.6
6	2110	3.1	1.6	2.2	10.5	6.8	8.3	12.5	10.5	11.8	16.3	11.9	13.7
7	1755	17.3	5.7	11.1	18.6	13.7	15.5	18.9	9.8	15.9	25.6	18.8	21.6
8	1890	5.8	2.5	3.7	17.0	9.7	12.6	18.6	11.5	15.9	23.9	15.8	20.4
9	1975	5.2	1.9	3.0	14.2	6.9	9.2	15.8	10.2	12.1	19.7	14.2	17.0
10	1955	8.1	2.7	4.8	15.4	9.0	11.9	16.3	10.5	12.8	19.9	13.9	17.2
11	2005	8.6	2.7	4.4	17.8	10.1	13.7	17.8	11.9	15.0	21.5	14.9	18.5
12	2035	7.4	1.8	4.2	13.5	7.5	10.9	14.6	10.0	12.2	19.8	[illegible]	16.9
13	1870	6.4	2.5	4.2	17.5	7.0	11.5	18.8	9.6	14.3	21.7	12.1	17.1
14	1885	7.9	2.0	4.3	14.3	7.9	10.7	16.8	10.1	13.4	21.8	12.7	18.9
15	2160	4.3	1.7	2.6	12.0	6.9	9.2	12.6	9.3	10.5	17.4	10.8	13.5
16	1945	17.5	8.4	12.5	17.5	12.6	14.7	17.5	12.6	14.7	21.9	17.4	20.4
16a	1920	16.4	3.7	9.2	16.4	8.3	13.5	16.4	8.5	13.7	22.8	16.1	19.7
17	2020	7.7	1.5	3.8	15.2	9.9	12.5	15.4	12.3	14.0	21.1	15.9	18.8
18	1865	12.6	3.7	5.6	19.1	11.6	14.7	19.4	11.6	15.0	22.7	15.6	19.1
19	2075	5.5	2.7	3.5	14.7	10.3	11.8	15.9	10.4	12.3	18.7	14.5	16.1
20	1895	11.4	2.3	4.9	15.7	9.3	12.2	16.2	9.3	13.7	23.1	14.5	18.7
21	1880	9.2	2.1	4.3	16.9	7.3	11.4	17.4	9.4	12.8	23.6	13.1	18.1
22	1920	8.1	2.4	4.4	15.6	10.7	12.7	15.6	11.6	13.4	22.2	14.6	18.1
23	2060	3.7	1.7	2.4	11.7	6.5	8.5	12.6	9.0	10.5	17.4	12.4	14.4
24	1925	6.0	2.3	3.5	14.9	9.2	11.9	15.0	11.0	13.0	19.8	14.1	17.2
25	1925	15.6	5.5	12.6	15.6	9.9	13.4	15.6	11.6	13.5	20.4	17.2	18.7

TABLE 6. DISTRIBUTION OF ABSORPTIONS, 5-HR. BOIL

Range of absorption percentage (Brick No.)	1	2	2a	3	4	5	6	7	8	9	10	11	12	13	14	15	16	16a	17	18	19	20	21	22	23	24	25
10.0–10.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....
11.0–11.9	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....
12.0–12.9	....	2	27	....	5	....	9	....	....	....	....	....	....	2	1	15	....	....	....	....	....	....	....	....	3	....	....
13.0–13.9	....	2	9	....	7	4	18	....	....	....	1	....	1	6	—	10	....	....	....	....	....	....	4	....	19	....	....
14.0–14.9	5	4	10	....	5	11	13	....	....	4	3	1	2	3	1	8	....	....	....	....	7	2	2	2	16	2	....
15.0–15.9	6	22	4	1	9	12	5	....	1	7	8	1	7	6	3	3	....	....	1	1	16	2	6	2	4	11	....
16.0–16.9	6	13	....	1	7	18	1	....	—	17	9	8	10	4	2	3	....	4	—	—	18	4	5	7	6	7	....
17.0–17.9	8	2	....	4	9	5	....	....	3	9	14	12	11	9	6	1	1	6	5	11	8	9	3	15	1	15	9
18.0–18.9	13	3	....	14	2	....	....	1	4	8	8	11	5	9	10	....	4	8	18	12	1	10	8	11	....	13	22
19.0–19.9	4	1	....	11	5	....	....	5	6	5	7	5	4	5	13	....	14	10	21	12	....	11	5	4	....	6	15
20.0–20.9	3	—	....	10	1	....	....	4	14	....	....	7	....	2	7	....	15	13	4	8	....	7	3	5	....	....	4
21.0–21.9	2	1	....	9	....	....	....	18	11	....	....	5	....	4	6	....	13	7	1	3	....	4	7	3	....	....	....
22.0–22.9	3	....	....	....	....	....	....	14	7	....	....	....	....	....	....	....	....	2	....	3	....	—	2	1	....	....	....
23.0–23.9	....	....	....	....	....	....	....	6	4	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....
24.0–24.9	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
25.0–25.9	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	50	50	50	50	50	50	48	50	50	50	50	50	40	50	49	46	47	50	50	50	50	50	46	50	49	50	50

a decrease in modulus of rupture without affecting the compressive strength. The position in the steam cylinders may have some effect on the product. The side of the brick receiving the molding pressure is denser, as has been shown by Johnson.[2] This fact will cause a variation in modulus of rupture, depending on which side of the brick is placed upward in the transverse test.

Table 4 is arranged in order of increasing absorption after five-hour boiling, and apparently no relation exists between the absorption and any one of the three strengths measured.

2. *All Brick Tested*

(a) *Absorption*

In Table 5 are recorded the maximum, minimum, and average water absorptions for the various periods and conditions of total immersion of the 25 different manufacturers' brick. The weight per 1100 cu. cm. (bulk volume) is the average weight of the various brick, referred to the standard brick dimensions, 8 by 3¾ by 2¼ in. From the data in this table it is evident that no definite relation exists between the absorption during relatively brief periods of cold total immersion and the absorption after five hours of boiling when various makes of brick are considered. For example, brick Nos. 7 and 8 have nearly identical absorptions after boiling but widely different absorptions in the shorter periods of total immersion at normal room temperature.

In Fig. 5 the average five-hour boiling absorption of different makes of brick are plotted against the average weight as given in Table 5. Here as with brick all from the one producer an approximate relation is found. Table 6 gives the distribution of the percentage-absorption values for the five-hour boiling period. The values in the columns are the number of individual brick falling within the indicated limits. The ratios appearing in Table 7 again show the

[2]Some Physical Properties of Sand-Lime Brick, H. V. Johnson, Proceedings of the Sand-Lime Brick Association, 1926, page 61.

TABLE 7. RATIOS BETWEEN THE VARIOUS ABSORPTIONS

Brick No.	5 min. cold to 5 hr. cold	5 min. cold to 24 hr. cold	5 min. cold to 5 hr. boil	5 hr. cold to 24 hr. cold	5 hr. cold to 5 hr. boil	24 hr. cold to 5 hr. boil
1	....	....	....	.94	.83	.88
2	....	....	....	.88	.85	.96
2a	.22	.19	.17	.88	.76	.87
3	....	....	....	.97	.76	.78
4	.56	.53	.39	.93	.70	.75
5	.53	.52	.38	.98	.71	.73
6	.26	.19	.16	.70	.61	.86
7	.72	.70	.51	.98	.72	.74
8	.29	.23	.18	.79	.62	.77
9	.33	.25	.18	.76	.54	.71
10	.40	.37	.28	.93	.69	.75
11	.32	.29	.24	.92	.74	.81
12	.38	.34	.25	.89	.65	.72
13	.26	.21	.18	.80	.67	.84
14	.40	.32	.23	.80	.57	.71
15	.28	.25	.19	.88	.68	.78
16	.85	.85	.61	1.00	.72	.72
16a	.68	.67	.47	.99	.69	.70
17	.21	.19	.14	.89	.67	.75
18	.38	.37	.29	.98	.77	.79
19	.30	.28	.22	.96	.73	.76
20	.40	.36	.26	.89	.65	.73
21	.38	.34	.24	.89	.63	.71
22	.35	.33	.24	.95	.70	.74
23	.28	.23	.17	.81	.59	.73
24	.29	.27	.20	.92	.69	.76
25	.94	.93	.67	.99	.72	.72
Max.	.84	.93	.67	1.00	.85	.96
Min.	.21	.19	.14	.70	.54	.70
Avg.	.42	.38	.29	.90	.69	.77

TABLE 9. COMPRESSIVE STRENGTHS, ON EDGE, DISTRIBUTION

Compressive range, lb./sq. in. (Brick No.)	1	2	2a	3	4	5	6	7	8	9	10	11	12	13	14	15	16	16a	17	18	19	20	21	22	23	24	25
500–999	6	....	....	....	1	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....
1000–1499	19	....	....	4	14	21	....	3	....	....	....	....	15	....	....	....	....	....	....	....	....	....	8	....	....	1	....
1500–1999	15	5	....	15	15	17	1	16	....	....	....	4	7	....	....	....	....	2	4	3	....	....	19	1	....	4	2
2000–2499	6	12	....	16	8	2	4	13	....	1	1	17	2	....	5	14	4	5	30	25	5	6	3	3	....	13	20
2500–2999	3	9	....	4	....	....	13	3	1	5	10	16	1	1	24	18	13	13	4	11	22	16	3	18	1	13	16
3000–3499	1	17	2	1	....	....	13	....	13	14	9	3	....	1	9	8	16	10	....	....	12	17	1	13	2	7	1
3500–3999	....	6	19	....	....	....	6	....	9	14	8	....	....	17	....	5	4	8	....	....	....	1	....	5	6	....	....
4000–4499	....	1	17	....	....	....	....	....	13	5	8	....	....	11	....	....	....	....	....	....	....	....	....	....	8	....	....
4500–4999	....	....	2	....	....	....	....	....	3	1	1	....	....	6	....	....	....	....	....	....	....	....	....	....	14	....	....
5000–5499	....	....	....	....	....	....	....	....	1	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	7	....	....
5500–5999	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	—	....	....
6000–6499	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....
Total	45	50	40	40	38	40	37	36	40	40	37	40	28	40	38	35	37	38	38	39	39	40	34	40	39	38	39

TABLE 10. MODULI OF RUPTURE DISTRIBUTION

Mod. of rup. range, lb./sq. in. (Brick No.)	1	2	2a	3	4	5	6	7	8	9	10	11	12	13	14	15	16	16a	17	18	19	20	21	22	23	24	25
100–199	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
200–299	4	....	....	5	1	8	....	2	....	1	1	....	4	....	....	....	....	....	....	....	....	....	2	....	....	....	....
300–399	11	6	....	12	9	29	....	1	....	—	—	....	15	....	1	....	....	....	....	5	....	1	22	1	....	3	....
400–499	14	4	....	12	21	2	9	4	....	2	11	4	3	....	12	....	....	1	6	16	15	3	8	7	....	9	17
500–599	14	17	2	10	5	1	15	12	1	6	12	9	2	5	17	....	8	5	14	11	18	19	3	8	....	16	22
600–699	4	7	9	1	3	....	12	12	16	12	11	7	3	14	8	4	16	14	8	6	6	15	....	16	1	11	1
700–799	11	10	10	....	1	....	....	8	13	12	3	11	....	19	....	8	5	8	7	—	—	4	....	6	6	1	....
800–899	....	3	5	....	....	....	....	1	5	5	....	6	....	2	....	14	4	9	2	1	1	16	....	2	5	....	....
900–999	....	2	4	....	....	....	....	....	4	2	....	—	....	....	....	5	....	3	2	....	....	....	....	....	18	....	....
1000–1099	....	1	5	....	....	....	....	....	....	....	....	—	....	....	....	3	....	....	....	....	....	....	....	....	—	....	....
1100–1199	....	....	3	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	—	....	....
1200–1299	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....
Total	49	50	38	40	40	40	36	39	39	40	38	38	28	40	38	34	33	40	39	39	40	39	40	40	39	40	40

TABLE 11. COMPRESSIVE STRENGTHS, FLAT, DISTRIBUTION

Compressive range, lb./sq. in. (Brick No.)	1	2	2a	3	4	5	6	7	8	9	10	11	12	13	14	15	16	16a	17	18	19	20	21	22	23	24	25
500–999	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
1000–1499	6	2	....	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
1500–1999	9	3	....	8	10	5	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1	1	....	....	....	....
2000–2499	15	4	....	15	17	14	....	10	....	....	....	3	10	....	1	....	—	....	2	2	1	1	13	....	....	3	....
2500–2999	12	5	....	9	10	18	2	20	1	3	....	10	13	....	16	1	1	4	22	5	5	7	15	2	....	6	11
3000–3499	3	8	....	3	1	3	7	5	4	3	5	17	2	....	14	6	4	15	14	21	22	8	4	5	....	15	20
3500–3999	4	19	1	2	....	....	10	4	3	18	10	7	3	3	7	12	17	13	....	2	10	20	2	19	1	11	8
4000–4499	....	6	7	1	....	....	13	....	10	8	11	—	....	6	....	6	12	8	....	4	2	1	....	14	—	4	1
4500–4999	....	3	9	....	....	....	4	....	14	7	9	—	....	9	....	8	2	....	....	....	....	....	....	4	7	1	....
5000–5499	....	....	12	....	....	....	1	....	6	1	3	—	....	6	....	2	....	....	....	....	....	....	....	—	9	....	....
5500–5999	....	....	7	....	....	....	....	....	2	....	1	1	....	13	....	....	....	....	....	....	....	....	....	1	14	....	....
6000–6499	....	....	3	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	6	....	....
6500–6999	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....
Total	49	50	39	50	40	40	38	39	40	40	38	38	28	40	38	35	37	40	38	40	39	38	35	45	38	40	40

TABLE 8. TRANSVERSE AND COMPRESSIVE STRENGTHS OF BRICKS

Brick No.	Mod. of rupture lb. per sq. in. Max.	Min.	Avg.	Compressive, flat lb. per sq. in. Max.	Min.	Avg.	Compressive, edge lb. per sq. in. Max.	Min.	Avg.	Ratios: M. of R. to comp. flat	M. of R. to comp. edge	Comp. edge to c'mp. flat
1	765	180	460	3730	1260	2310	3050	600	1580	.20	.29	.69
2	1080	345	620	4770	1360	3350	4230	1650	2860	.18	.22	.85
2a	1180	570	820	6340	3850	5120	4750	3190	3970	.16	.21	.78
3	625	225	435	4140	990	2380	3060	1110	1990	.18	.22	.84
4	740	290	460	3040	1380	2150	2390	800	1530	.21	.30	.71
5	515	240	335	3070	1710	2460	2130	1040	1500	.14	.22	.61
6	670	455	550	5010	2620	3770	3870	1860	2940	.15	.19	.18
7	860	275	600	3860	2090	2810	2800	1430	1960	.21	.30	.70
8	950	575	730	5960	2960	4465	5075	2990	3850	.16	.19	.86
9	995	295	690	5140	2680	3930	4520	2470	3460	.18	.20	.88
10	790	295	565	5930	3310	4230	4880	2000	3390	.13	.17	.80
11	1115	430	680	5900	2360	3170	3430	1590	2480	.21	.27	.78
12	685	265	400	3720	2050	2700	2550	790	1460	.15	.27	.54
13	830	530	685	6200	3520	5050	6160	2890	4105	.14	.17	.81
14	665	385	530	3910	2480	3040	3460	2070	2800	.17	.19	.92
15	1030	605	830	5090	2520	4050	3870	2070	2980	.20	.28	.74
16	885	525	650	4650	1930	3820	3860	2240	3020	.17	.21	.79
16a	960	485	715	4480	2500	3570	3740	1630	2950	.20	.24	.83
17	965	415	620	3260	2440	2910	2730	1870	2270	.21	.27	.78
18	855	315	500	4300	2390	3330	2960	1590	2330	.15	.27	.70
19	830	415	530	4440	2230	3370	3440	2170	2890	.16	.18	.86
20	865	390	515	4250	1930	3420	3630	2200	2910	.15	.18	.85
21	585	245	385	3810	1890	2630	3310	1180	1820	.15	.21	.69
22	815	380	615	5520	2780	3880	3910	1990	2970	.16	.20	.76
23	1210	685	930	6870	3870	5500	6110	2790	4420	.17	.21	.80
24	705	330	550	4720	2040	3400	3470	1440	2490	.16	.21	.73
25	660	415	510	4130	2560	3210	3050	1930	2480	.16	.20	.77
Max.	......	......	......	......	......	......	......	......	......	.21	.31	.92
Min.	......	......	......	......	......	......	......	......	......	.13	.17	.54
Avg.	......	......	......	......	......	......	......	......	......	.17	.22	.77

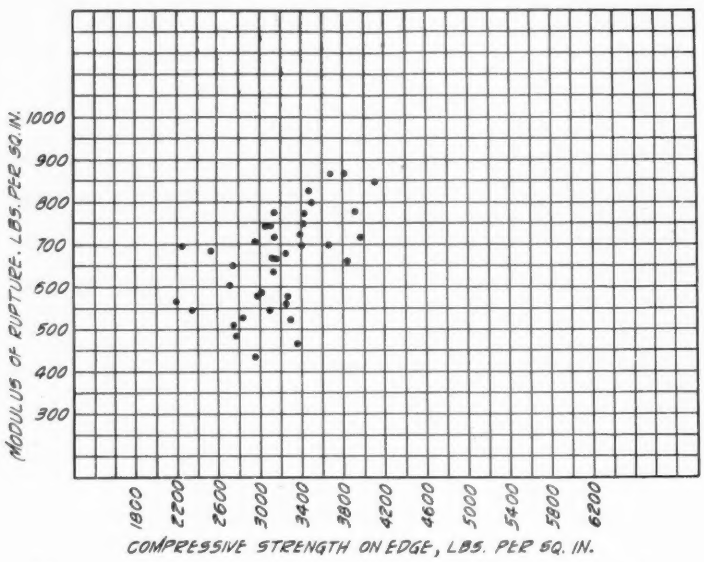


Fig. 3. Relation of individual moduli of rupture to individual compressive strengths, on edge, of brick No. 22

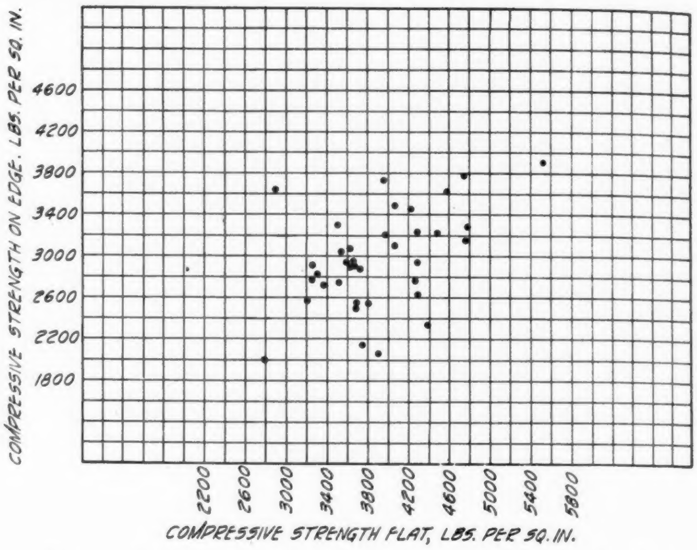


Fig. 4. Relation of individual compressive strengths, flat, to individual compressive strengths, on edge, brick No. 22

lack of relation between the absorptions at various periods when data from various makes of brick are considered. The percentage of the 24-hour cold absorption acquired in five minutes varies widely even among brick of similar absorptions in the 24-hour period. This is evident when the ratios of brick Nos. 7 and 8 are compared. The average value for the ratios between

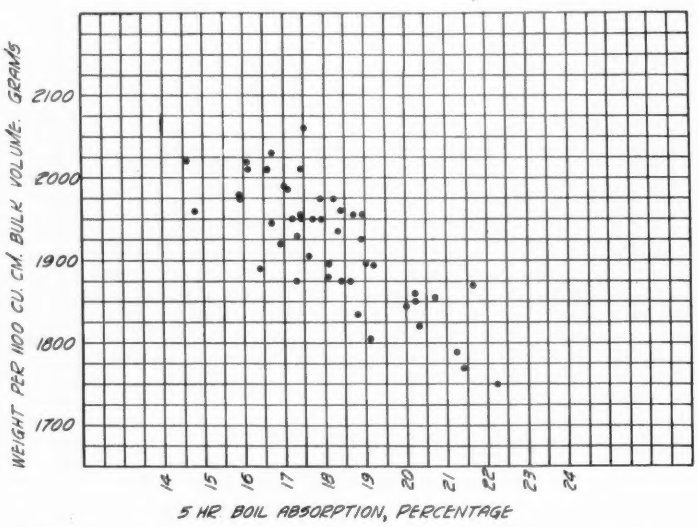


Fig. 5. Relation of average 5-hour boil absorptions for all makes to average weights

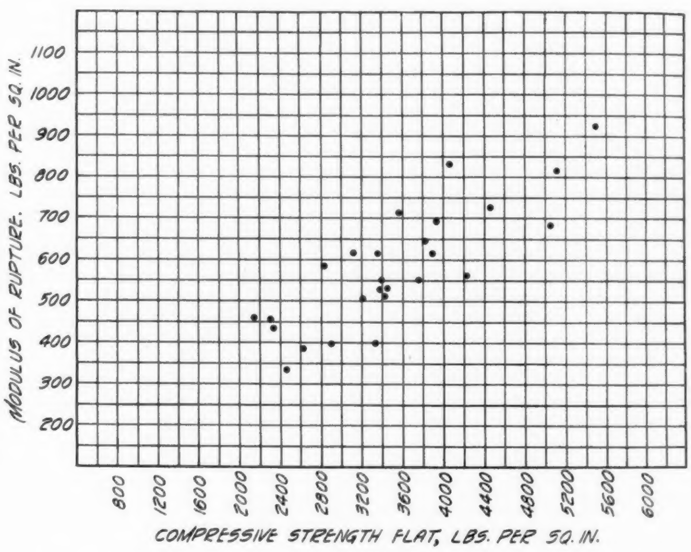


Fig. 6. Relation of average moduli of rupture to average compressive strengths, flat

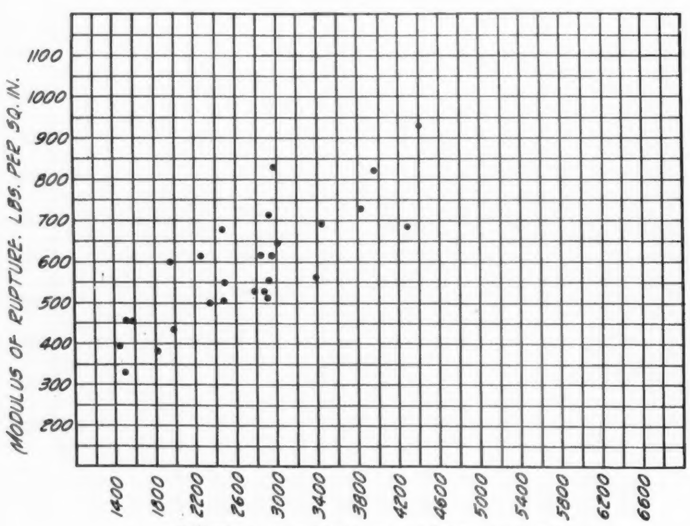


Fig. 7. Relation of average moduli of rupture to average compressive strengths, on edge

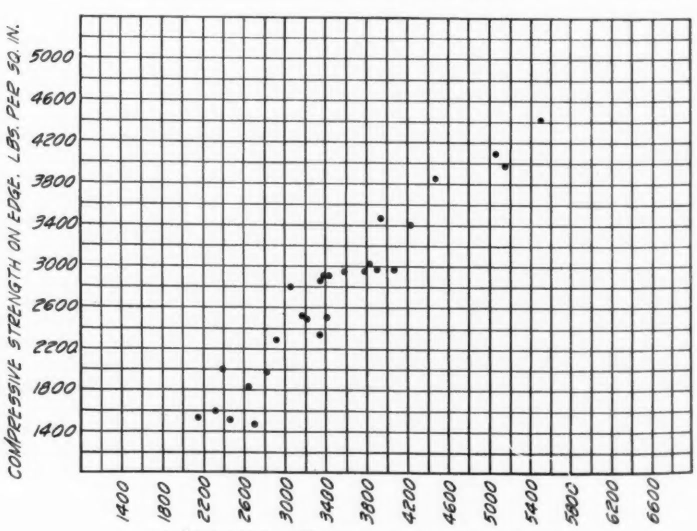


Fig. 8. Relation of average compressive strength, flat, to average compressive strengths, on edge

five-hour cold and five-hour boiling absorption is 0.69, considerably less than the 0.75 used in some specifications[3] for calculating the approximate five-hour boil absorption from the measured five-hour cold absorption. As indicated above, the ratio bears no relation to the five-hour boiling absorption when averages obtained from products of various manufacturers are considered.

(b) *Strength*

Table 8 gives the maximum, minimum and average values for compressive strength, flat and on edge, and for the moduli of rupture. The three ratios (modulus of rupture to compressive strength, flat and on edge, and compresive strength, flat, to compressive strength on edge) between the averages are recorded in the last three columns of this table. The distribution of these strength values for the various groups of brick are given in Tables 9, 10 and 11.

It is desirable to plot together data obtained from different makes of brick, because if a constant relation cannot be found it cannot be assumed in specifications that a certain transverse strength indicates a certain compressive strength. In Figs. 6, 7 and 8 the averages are plotted for all the brick of the 25 manufacturers. General relationships are here indicated. It is to be noted that these figures are drawn to the same scales as the corresponding plates of individual values (Figs. 2, 3 and 4).

3. Comparison of Relations

When considering one make of brick, a fair relation is found between the rate and the amount of absorption. With averages of different makes this relation does not exist. The reason is probably to be found in the different processes of manufacture and in differences in materials and proportions. Differences in surface condition will influence this relation and will be apt to be present to a much greater extent among brick of different makes.

The relation between bulk density and absorption is found to exist both among brick of one make and brick of different makes. The reason for this is explained by Johnson,[2] who has found that true specific gravity of various makes of sand-lime brick is almost constant, the factor determining the bulk density of a brick being the amount of total pore space.

The average strength values give a general relationship while the individual values do not. The factors which affect the individual values tend to compensate for each other when averages are taken, and a rough relationship results. It is evident, however, from the scattering of points in Figs. 2, 3 and 4 that if all individual values are plotted for all makes, the scattering of points will greatly exceed that shown where averages of groups of 40 have been plotted.

[3]Circular, Bureau of Standards, No. 347.

Conclusions

1. The absorptions at five-minutes' and five-hours' total immersion bore no distinct relation to the absorption after five hours of boiling when different makes of brick were considered. An approximate relationship was found among bricks all from one producer.

2. The bulk density was fairly well related to the absorption after five hours of boiling, both in the case of bricks of the same make and averages of different producers.

3. The average ration of the five-hour cold total immersion absorption to the absorption after five hours of boiling was 0.69, which was less than the 0.75 used in specifications. The value of the ratio did not appear to be related to the total absorption.

4. The various strength values of individual brick bore no apparent relation to one another. However, an approximate relation was obtained when averages of 40 specimens were used, even though the different groups of 40 were representative of products of different manufacturers.

Increased Production of Fuller's Earth in 1928

THE FULLER'S EARTH sold or used by producers in the United States in 1928 amounted to 287,012 short tons, valued at $3,895,991, it is announced by the United States Bureau of Mines, Department of Commerce, which has collected statistics in cooperation with the Geological Surveys of Florida, Georgia, Illinois and Texas. This is an increase of 9% in quantity and 3% in value compared with 1927. Every producing state except Georgia showed an increase, and one state that has not reported production for many years—Colorado—re-entered the list of producers. The output was reported by 17 operators in eight states in 1928, namely, Arizona, Colorado, Florida, Georgia, Illinois, Massachusetts, Nevada and Texas. Georgia was the leading state in production in 1928, with Florida second and Nevada third. These three states produced 77% of the total output. The average value per ton of fuller's earth was $13.57 in 1928 compared with $14.24 in 1927.

Fuller's earth is a term used to include a variety of natural substances that possess the property of absorbing grease or clarifying, bleaching or filtering oil. They are mostly clay-like substances, though recently discovered material in the west, which is of different character, is said to be of excellent quality. The original use of fuller's earth was in the fulling of cloth, but little of it is now used for this purpose. It is used almost exclusively in the bleaching or filtering of mineral and vegetable oils.

Until 1895, when fuller's earth was successfully produced commercially in Florida, the United States was entirely dependent on foreign supplies. In 1928 the imports of fuller's earth were 7592 short tons, valued at $132,003, practically the same in quantity, but an increase of 21% in value compared with 1927.

The exports of fuller's earth are not separately shown in the official records of the foreign commerce of the United States, but eight producers reported to the Bureau of Mines that in 1928 they exported 16,494 short tons of fuller's earth, which was an increase of 34% over 1927.

Chemical Engineering Catalog

THE 1929 edition of the Chemical Engineering Catalog contains the representation of more firms than any previous edition. It shows, moreover, a considerable development in the amount of detailed information furnished by each firm.

The changes in the index, effected last year, in which a separate index of equipment and supplies and another for chemicals and raw materials are given, have been retained, this form having been found to be most convenient to users. Further, the chemical index has been supplemented and made more complete by the listings of chemical firms who are not advertisers in the catalog.

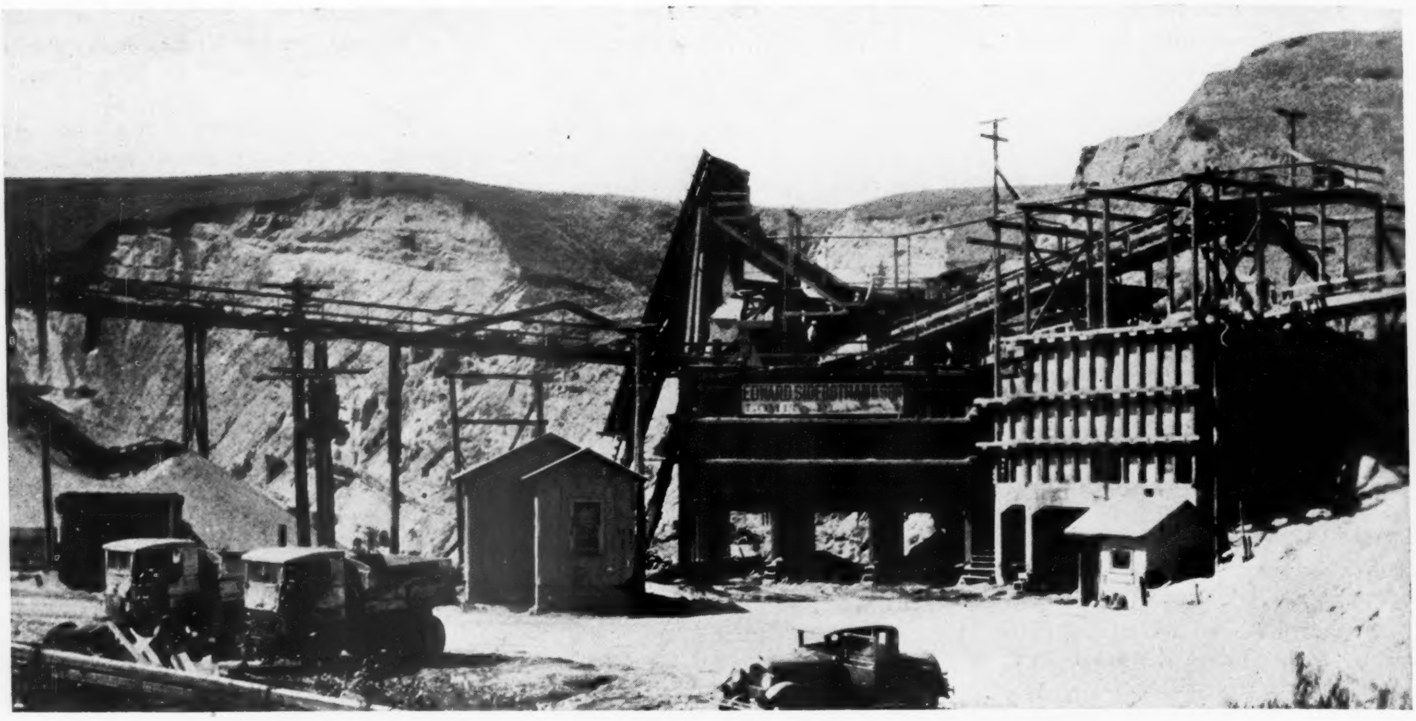
Of great importance is the technical and scientific book section, in which 2600 books are listed and described. There is also a subject index so that information on any particular topic may be had readily. A detailed list of scientific and technical monographs, now ready for delivery or in preparation, is also given.

The catalog is distributed by the Chemical Catalog Co., Inc., New York City, under a plan by which people or concerns actively connected with chemical engineering or chemical plants, laboratories, scientific institutions receive a copy free for use until the next edition on request. Should the receivers wish to keep the book permanently a charge of $3 is made. To others outside of the classes mentioned above, a fixed charge of $10 per copy is made.

Lime Consumption in Flotation of Ore Pulps

LARGE AMOUNTS of lime are used in metal industries, chiefly among those who use the flotation method for the alkaline ore pulps. The research staff of the United Verde Copper Co. has made a study of the various changes taking place in a mill pulp at different stages in the flotation process; this research has been incorporated into Technical Publication No. 244 of the A. S. M. E.

Of interest to lime producers are the data on lime consumption. The paper states that in that particular plant, 0.36 lb. of CaO per ton of water used is necessary to soften the water and in addition from 4.3 to 9.0 lb. of CaO must be added to the ore. In actuality, excess lime, 12 lb. per ton of ore, is used.



Sand and gravel plant operated by Edward Sidebotham and Son at Lomita, Calif.

Efficient Gravel Cleaning With Jigs

Edward Sidebotham and Son, Lomita, Calif., Uses Them to Remove Shale

By Edmund Shaw
Contributing Editor, Rock Products

THE freeing of gravel from clay balls, soft sandrock, shale, and trash of one sort or another is a problem that has been growing in importance the past four or five years. In certain parts of the country its solution is essential to the continuance of the industry, for the surveys of highway departments in some states have shown that gravel which is sufficiently free from these substances for use in highway concrete is fast being exhausted. Not only producers but machinery manufacturers and inventors have appreciated this and some of the devices which they have put on the market in some cases have produced salable material. In others, especially in localities where the gravel contained shale, they have not been so successful.

The writer is among those who have given considerable study to freeing sand and gravel from such deleterious materials, hence he was pleased to learn of a plant in which the problem seems to be as nearly solved as in any of which he has heard. This is the plant of Edward Sidebotham and Son, at Lomita, near Los Angeles, Calif. The method has been in use for more than a year now and it's success has been so marked that a new plant is being built with twice the capacity of the present plant.

While the plant is primarily a sand plant, about 20% of gravel is produced and up to a few years ago this was sold without any trouble. Then specifications were changed and the severe rattler test was introduced for material for city and county jobs, which the gravel could not pass. So it was allowed to accumulate, or disposed of for road material, until it was seen that this could not continue long. In the meantime Mr. Sidebotham had studied the material and experimented with it. The machinery houses he went to for advice insisted that what he needed was some kind of a log washer, but he had found out that while this might remove part of the impurities there were others which it would not remove at all.

The impurities consisted of about 3% of shale (as nearly as can be estimated) along with some clayballs. The shale varies considerably in character. Many of the shale pebbles are quite hard and not easily broken with the fingers, and when they are wet a casual glance would lead one to believe they were fairly good gravel material. Other pebbles contain oil, for the operation is in an oil country, close to the Torrance-Lomita field. Such shale pebbles could not be removed by any device of the log washer type, however successful it might be with clayballs and trash.

This left only the jig as a cleaning device. Mr. Sidebotham knew a lot about jigs for he had built and operated a good many of them in the years when he was a millwright for one of the big copper companies in Arizona. There are several types of jigs in use in coal washing and ore dressing plants, and after studying the advantages of each, as a gravel washing device, he finally settled on one of the oldest and simplest forms, the Hartz type.

The machine cost about $1000 to build and install. Its capacity has never been fully reached but it has treated as much as 100 tons in eight hours, reducing the shale content from 3% to less than ½%. A 5-hp. motor drives it easily and the principal expense is that of pumping the water required. Just how much water is needed has not been determined, but the entire plant circulates only 250 g. p. m. so the amount cannot be very large. The only repair cost is that of screens, which are very cheap, and the attendance is part of the time of one man who looks after all the screening and washing and the stockpiling.

A full description of the Hartz jig may be found in almost any book on coal washing or ore dressing, hence it is not necessary to include it here. Briefly it consists of a long wooden tank which is divided at the top into cells. These cells are in pairs, both opening

into the tank. In one cell is a rectangular plunger which is moved up and down by an eccentric, giving the water a surging motion. The gravel and water flow across the other cell, lengthwise, over a screen. Water is pumped into the tank and as the cell with the gravel is lower than the plunger cell the water rises through the screen and the gravel and tends to lift the lighter particles, and the surging motion of the water helps it to do this. The gravel is thus stratified, the lighter shale pebbles and the clayballs and trash coming to the top while the heavier gravel stays on the screens.

The gravel is discharged by a side gate which is in a box raised 1½ in., just enough to allow the largest pieces in the feed to slip under it. The gravel rises in this box and flows over a gate to a chute that leads to the bin, and if the gate is set right the gravel is discharged without any surplus water.

Four Pair of Washing Cells

There are four pairs of cells, each pair with its own plunger and washing cells, and the gravel flows from one to the other. There is a drop of 1½ in. from one cell to the next so that it will flow this way. Hence the gravel is cleaned four times. The first cell contains gravel with a little shale and the last cell contains shale with only a little gravel. The separation may be made as complete as desired, for by allowing a little gravel to go out with the shale no shale will go into the gravel.

The entire jig is about 10 ft. long and 4 ft. wide on top and 4½ ft. deep inside. The plunger cells and jigging cells are all of the same size, 18x24 in. All the plunger eccentrics are on the same shaft and this is driven through gears by the 5-hp. motor which is of the slow speed type, the shaft making 80 r. p. m. The length of the stroke is about 1 in. on the first cell and ¾ in. on the others, because the load is heavier on the first cell. Speed and the length of stroke are those which have been found suitable.

Jigs have been used in other plants for cleaning gravel, the best known, perhaps, being the plant of the Central Sand and Gravel Co., Memphis, Tenn. This was described in Rock Products, issue of September 18, 1926, and it was noted that considerable labor was needed to keep the screens of the jig from blinding. When the jig at the Sidebotham plant was started there was the same trouble but it was overcome by using a smaller screen mesh. The present screens are made of "hardware cloth," 8 meshes to the inch. This is very light and has to be supported by a coarse mesh screen which is placed over a wooden grating, grating, but the material is so cheap that it costs less to use it, and change it once a week, than it does to use a more substantial screen cloth.

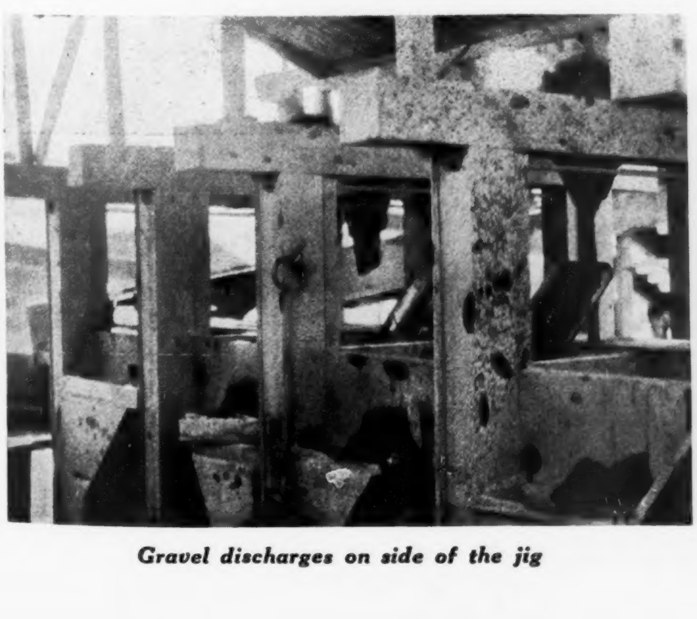
The feed is from ⅜ in. to 1¼ in. Hence there are no particles small enough to get into the screen meshes and the screen cannot blind.

There is a little clay and sand with the feed that goes to the jig but this is pulled down through the screens by the suction stroke of the plunger. It is all discharged through valves, one to each cell, which are kept open so that a mud dribbles away continuously.

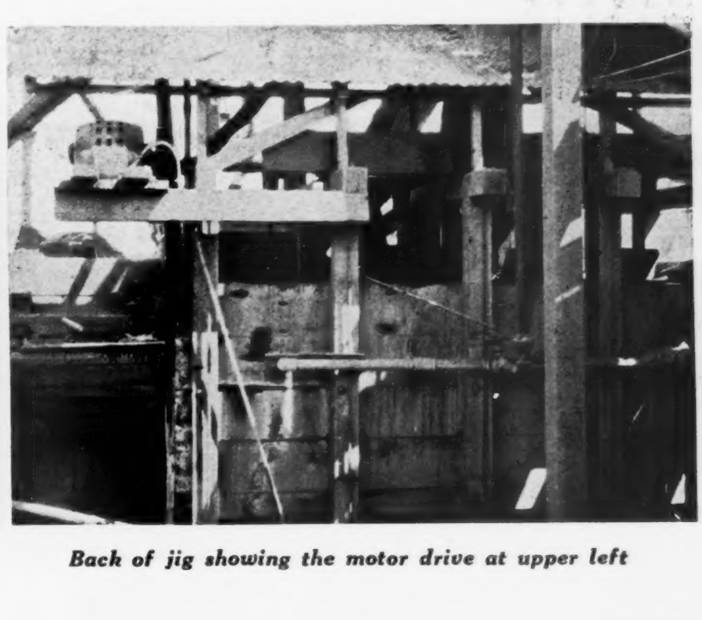
The scraper bucket has worked nine years in this track at the deposit

In the plant that is building, there are two jigs and they will be run like the present jig except that the feed will be from a hopper through a "cross" feeder, Link-Belt type. It has been noted that both the capacity and the cleanliness of the separation are increased when the feed to the jig is uniform.

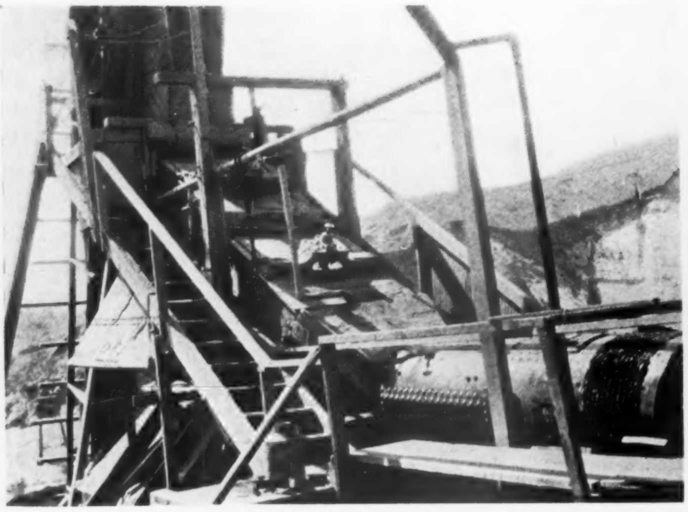
For the benefit of other producers who may wish to try jigging as a cleaning method, it may be stated that the patents on this



Gravel discharges on side of the jig



Back of jig showing the motor drive at upper left



Screens at the No. 1 plant

End of jig with shale discharge on the screen

machine have long since expired. Working drawings can be made from the drawings found in such text books as Prof. Richard's "Ore Dressing," which can be found in most large public libraries. The eccentrics and other iron work may be bought from any large house that deals in mining machinery.

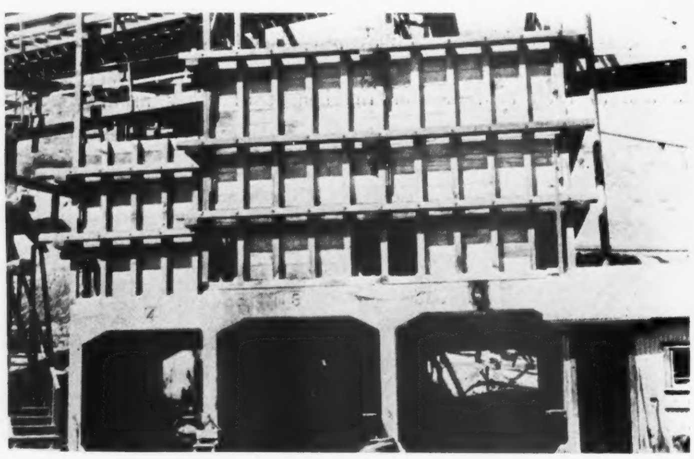
The jig is by no means the only interesting feature of the Sidebotham operation, for there are others that should interest plant operators who have difficult conditions to meet. The water system is perhaps the most important of these.

Water Supply

The water supply is from a 4-in. Layne and Bowler centrifugal pump, which is placed in the bottom of the well. The pump is 200 ft. below the surface, but there is usually 50 ft. to 60 ft. of water over it. It pumps about 365 g.p.m. to a large concrete tank which holds sufficient water to keep the plant running for some time, if the pump has to be shut down for repairs or any other reason.

The water is drawn from this tank through a float valve, and the float is in a small tank that receives the clarified water from the settling tanks before it is sent back to the mill. When this water is less than the normal amount the pump draws down the water level and the float falls, opening the valve and allowing fresh water to run in until the amount in circulation is normal.

The settling tanks, in which the muddy water from the plant is clarified for re-use, are of concrete, and there are six in one block which is 65 ft. by 22 ft. A tank at one end receives the overflows from the jigs and classifiers, and the overflow is across level partitions between the tanks. The overflow from the last tank goes through a screen to remove floating trash before it is sent to the pump mentioned above as pumping from the small tank.



Below — Concrete and timber bins at the No. 1 plant

The bottom of these tanks slopes to $7\frac{1}{2}$ ft. on the deep side. When a tank is to be cleaned, a valve on this side is opened and the mud flushed out by siphoning water from the next tank. As a tank is not cleaned until it is well filled with mud, little water is wasted. A hoe is used to help the mud to run out.

This mud is valuable, as it makes good clay roofing tile, which are much used in the locality. However, for the present, it is run out into a small pond and settled. The water that goes out with this clay is all that escapes from the plant. In fact, every care is taken to see that no other water does escape anywhere and that the sand and gravel are dry enough so that the loads do not drip as they are hauled through the streets. The plant is in a good residence district and local ordinances are very strict about such matters. The bins are drained by having the slanting bottoms of loose boards, the cracks being covered by screening.

The deposit, like most of those worked in southern California, is of great depth. The hill being worked at the No. 1 plant, where the jig is working, is 200 ft. high and all sand and gravel. The scraper bucket used to dig the material has been running in the same track for nine years, of course going farther into the hill all the time. Drill holes have shown that there is at least 500 ft. of just as good material below the surface.

The new plant—note the jigs and feed hopper above

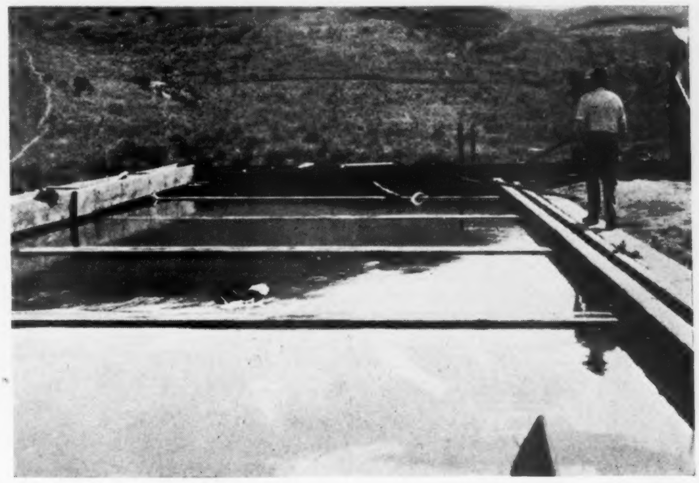
The scraper bucket is of the Le Clair type, of 3 cu. yd. capacity, and pulled by a "Western" hoist with a 100-hp. motor. It empties into a hopper from which the material runs into an elevator that discharges directly to two "Hum-mer" screens in series. The first

has 6-mesh wire cloth, which takes out plaster sand, and the second has a ⅜-in. mesh cloth that takes out concrete sand. As some of the fines taken out by the first screen are needed in the concrete sand, a chute and sliding gate is arranged to put some of the discharge of the first screen into the discharge of the second. In this way the grading may be regulated as desired.

Before this mixing is done, however, the discharges of both screens are washed in Bodenson classifiers, which are machines of the rake type.

The oversize of the second screen (plus ⅜-in.) goes to a scrubber which has a 1¼-in. square mesh screen at the end. Every-

Shovel opening up new ground



The 65x22 ft. block of settling tanks

thing that passes this screen is sent to the jig. The oversize goes to a bin from which it is sold as a road material.

The No. 2 Sidebotham plant produces dry-screened sand principally. There is a great demand for this by masons and contractors. It is this plant which is to be replaced by the plant now under construction where two jigs will be employed.

The company, Edward Sidebotham and Son, Inc., does a large building material business and has offices and yards in San Pedro, Wilmington and Hermosa Beach. It operates a fleet of 20 trucks all of "Auto-Car" make.

Physical Characteristics of Slag Aggregate

FROM the standpoint of the engineer who wants exact figures showing the physical characteristics of the materials he uses, Symposium No. 14 of the National Slag Association's series is probably the most important. It gives such figures in abundant detail and in many cases compares them with the same figures for other aggregates.

According to this symposium, the *color* of slag aggregate is gray, or bluish gray, and the concrete made from it is of varying shades of gray, none of which is far from the color of portland cement. The *odor* of slag is sometimes perceptible (the odor of sulphuretted hydrogen), but it disappears after the slag is made into concrete. *Cleanliness* is greater with slags than with other aggregates as a rule, because all organic matter is destroyed in the furnace. The *melting point* has been determined by Rankin and Wright to lie between 2138 and 2606 deg. F. *Uniformity* is not a characteristic of slag aggregate, individual pieces showing a considerable variation in density, but this variation is not a serious matter, as concrete made from light slags has been shown to have practically the same compressive strength as that from heavy slags.

The *specific gravity* is either the "apparent specific gravity," which does not take account of the cells in the slag, or the "true specific gravity," which is that of the slag so finely pulverized that the cells are destroyed. According to some of the authorities quoted the apparent specific gravity of slag is:

Harsch, average of slag from 20 plants	2.11
Hubbard, average of 24 sources	2.12
Rea, 13 Ohio plants, deleting light samples	2.17
Abrams, 19 slags from eight states	2.26
U. S. Bureau of Public Roads, 20 samples	2.35

Some quoted findings of the true specific gravity of slag are:

Reeve and Lewis	2.81-2.89
Abrams	2.88-2.89
Dequesne Slag Products Co.	3.00-3.20
Passow (Germany)	2.80-2.98
Guttman (Germany)	2.65-3.16

The *weight per cubic foot* is one of the most important characteristics, as most specifications call for a weight of 70 lb. for slag aggregate, dry and rodded. The weight may vary greatly, according to the size to which the slag is crushed and the grading. A few of the determinations quoted are:

	Loose, lb.	Rodded, lb.
Hubbard, sized, 1½- to 2½-in.	63.6	74.9
Hubbard, graded, ¼- to 1½-in.	69.0	80.0
A.S.T.M., 1- to 1½-in.	......	78.2
A.S.T.M., ¼- to 1¼-in.	......	86.4
Abrams, ¼- to 1½-in.	......	88.0
Freeman, ¼- to 1¼-in.	......	74.0

The above have been chosen as typical from many examples given in the symposium.

The possibilities of making heavier and lighter slags are mentioned and it is shown that such slags have been made experimentally. The weight of granulated (water cooled) slag is given as from 40 to 60 lb. by different authorities.

The *weight of slag concrete* is generally held to be 8 to 10 lb. lighter than that of concrete made from either stone or gravel, and this is borne out by the figures given from many sources. A typical example is from Harsch's slag survey for the United States Bureau of Public Roads in which 1:2:3 concrete was made from slag from 19 plants. The averages taken from his table are:

	Weight per Cu. Ft. Compact, Lb.	Weight Concrete per Cu. Ft., Lb.
Average slag	86.4	140.3
Limestone	102.5	151.3
Gravel	110.5	146.0
Examples from J. P. Freeman's table, 1:2:4 concrete:		
Slag	75.0	140.0
Stone	94.8	150.0
Gravel	95.0	143.0
1:4 concrete, tested by the Portland Cement Association, averages from table:		
Slag	80.0	142.0
Stone	91.0	148.0
Gravel	102.0	150.0

The above concretes were made with natural sand as fine aggregate. Concretes made from all slag aggregate are shown to weigh from 121 to 138 lb. per cu. ft.

The *voids* of crushed slag are said to average 41% for the dry and rodded state, but the percentage of voids varies with the size and grading as it does with crushed stone and gravel.

The *hardness* of slag is stated to equal that of most natural rocks and to be only a little less than that of the hardest rocks. In *toughness*, slag falls a little below the toughest rocks, but examples given show the toughness of slag concrete to equal that of concrete made from the toughest rocks.

Free Lime in Portland Cement

By S. L. Meyers
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A METHOD for the determination of free lime in portland cement has been sought for from the earliest days of the cement industry. Many of the most eminent research works of Europe and America in this field have tried a multitude of ingenious methods for its determination, not only because of its value in plant control but also for the light it would shed on the speculative side of the constitution of portland cement clinker. Owing to the fact that most of the methods tried altered the mineral structure of the cement during the operation, no one had a great measure of success until Lerch and Bogue developed the ammonium acetate method conducted in anhydrous ethyl alcohol and glycerine, which gives fairly consistent results if run with a great deal of care. This method is not used as extensively as the value of a free lime determination would justify because for daily routine determinations it is rather tedious for the following reasons:

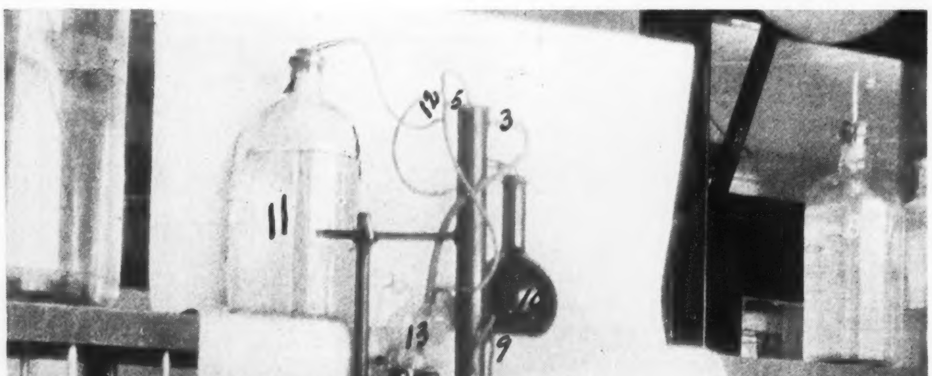
(1) The air should be excluded during the entire operation as the reagents absorb both moisture and carbon dioxide present in the air, the moisture hydrating the cement which sets lime free, and carbon dioxide has the opposite end effect as it combines with lime.

(2) Alcohol should not be lost by evaporation either through faulty refluxing or while it is being titrated away from the condenser. The concentration of glycerine in the alcohol should be kept fairly constant—if too low the reaction proceeds too slowly—if too high, the cement is attacked by the glycerine.

(3) A permit is necessary to obtain specially denatured alcohol, and the method of preparing anhydrous alcohol by distilling over strongly hygroscopic substances is laborious to obtain the requisite dryness.

(4) A great amount of time is required for the determination.

The apparatus illustrated here is designed to expedite and simplify the ammonium acetate method. The reagent is added while the titration flask is connected to a reflux condenser and its contents continue to boil without disturbance. All air is excluded (except air originally in the titration flask) during the entire operation and the proportions of glycerine and alcohol remain the same, because the refluxing is so effective that no alcohol escapes. The time is more than cut in half by the use of a shaker. Completely denatured anhydrous alcohol gives satisfactory results and can be purchased without a permit or bond.



Modified apparatus for determining free lime in portland cement

Description of Apparatus

The free lime apparatus is designed to run three determinations simultaneously.

An iron pipe (1) serves as the shell of the condenser. Water enters at (2) and escapes at (3). The small copper pipes (4) are sealed within the condenser and come to a common outlet (5) at the top. A short flexible rubber tube connects each of the flasks (6), in which the operator is being conducted, to its own copper pipe which serves as a reflex condenser. Three 5-c.c. burettes (7) sit on the side of and next to the condenser shell. Each connects to its own flask by a tiny rubber tube, pinchcock and glass capillary outlet tube (8). The top of the burettes come to a common outlet (9). The ammonium acetate reagent is kept in a black bottle (10) and flows by gravity into the titration burettes (7) when the proper clamps are opened to allow the burette to fill to the zero mark. (11) Contains 6:1 anhydrous alcohol and U.S.P. glycerine with a small amount of the phenolpthalein indicator. Parts (5), (9), (10) and (11) are connected to a manifold (12) whose only escape is through the potash and sulphuric acid containers (13). The three titration flasks (6) sit in a shallow pan (14) attached to a ring supported by a spring (15). A leather belt with an enlarged section passes from the motor pulley (16) to the revolving wheel (17). Each time the enlarged belt section passes over (17) the wheel is displaced and the pan and flasks are agitated.

A small electric heater (18) sits directly under the pan and flasks.

As some of the heat from the heater passes up through the pan and past the flasks to the burettes the reagent would be heated above room temperature and expanded if the burettes were not in contact with the condenser shell through which cold water circulates.

The small rubber tubing, capillary connections to flasks and reagent reservoir and the clamps give greater satisfaction than glass stopcocks, as the latter allows leakage of the very fluid alcoholic ammonium acetate.

The outlets from the burettes to the flasks should be capillary, as otherwise the vapor pressure in the reagent near the outlet will be sufficient to expel the reagent from a larger bore, owing to the heat received from the hot vapors in the titrating flasks.

The determination procedure follows:

Clinker or cement is measured out in a measure holding slightly more than 1 gram and passed through a 300-mesh sieve with the aid of an agate mortar and pestle. One gram of this fine material is put into a 50 ml. Erlenmeyer flask and then 25 c.c. of the solvent alcohol, glycerine and phenolpthalein are run into the flask. The flask is connected to one of the copper reflux pipes, the heater is turned on, also the motor which operates the shaker.

The ammonium acetate solution is added at 10 minute intervals. If after the last addition of reagent a 15 minute period elapses without any color development, the reaction has reached completion.

The c.c. of reagent used is read and multiplied by the factor for free lime. This gives the percentage of free lime in the sample.

The length of time required increases with the free lime content and the age of the cement. For clinkers and fresh cements with a free lime content of 1.5% or less, all of the reaction will have occurred in 1½ hours. For free lime greater than this, or for aged cements, 2 to 3 hours might be required, but these periods are less than half of those required by the regular procedure, where the flask is disconnected from the reflux condensor for each titration and no shaker or agitator is used.

to the burners, since it is an index of how hard the clinkers are being burned for given conditions. On the one hand the burners want to avoid high free lime with possible unsoundness and low strengths. On the other hand it is poor fuel economy to burn the clinkers until all of the free lime has disappeared. A free lime can be run in an hour or two, whereas a soundness test does not give results until the next day when new conditions might exist in the kiln burning zone. Further, the boil or soundness test only gives information as to whether the clinker is burned decidedly bad or not, and tells nothing beyond this as to intermediate stages of burning.

Although free lime is the main direct, and possibly the only cause of unsoundness, it is not an absolute criterion of unsoundness.

There are variable factors such as: Degree of fineness of grinding, rate of hydration of free lime present, ratio of rapid hardening to slow hardening constituents. In short, soundness is the results of cohesive forces on the one hand, balanced against expansive forces on the other. However, after several free lime determinations and comparisons with results from boil tests, one soon gets familiar with a type of clinker and it is possible to predict the soundness test from the free lime present with only a narrow doubtful margin of a few tenths of a per cent.

A knowledge of free lime in the clinker tells the chemist in advance not only as to its soundness, but it allows him to calculate the mineral constituents present with more definiteness. It shows him the degree of completion of combination, and it allows him to find the percentage limits of the constituents of the clinker.

Quite often one sees calculations of clinker or cement constituents where the free lime is assumed to be zero, or some hypothetical value is given to it. Following are some calculations which show the effect of varying quantities of free lime in a clinker with a composition of: Silica, 22.00; alumina, 6.00; iron oxide, 3.00; lime, 65.00; magnesia, alkalies, ignition loss, sulphates and other minor constituents that might be present but whose effect cannot at present be calculated are omitted:

Free lime	None	1%	2%	4%
Four calcium aluminum ferrite	9.12	9.12	9.12	9.12
Tricalcium aluminate	10.79	10.79	10.79	10.79
Tricalcium silicate	53.65	49.62	45.50	37.38
Dicalcium silicate	22.43	25.46	28.58	34.70
$\frac{3CaO\cdot SiO_2}{2CaO\cdot SiO_2}$	2.39	1.95	1.59	1.08

The ammonium acetate is standardized against calcined calcite in the usual way, using 16 gram to 1 liter of alcohol. Quick lime seems to be the most satisfactory dessicator for drying the ammonium acetate.

Not only is a free lime determination of value to the chemist but it is also of value

Since cement made from a clinker with a 2.39 ratio between the silicates will have markedly different properties as compared to one made from a 1.08 clinker, the labor of a daily free lime analysis on the clinker burned will well repay the chemist in most plants.

Crystal Structure of Tricalcium Aluminate

RECENT examination of tricalcium aluminate ($3CaO\cdot Al_2O_3$) shows a type of structure quite different than that predicted for it several years ago. Instead of the complex mineral containing molecules of the component oxides, the x-ray crystal analysis indicates the structure to be "mixed ionic," that is, the metallic elements and the oxygen all enter the compound as separate crystallographic entities.

It is with the determination of this type of structure and the sort of chemical combination that F. A. Steele and W. P. Davey deal with in their paper on the subject (see *Jour. Amer. Chem. Soc.*, 1929, **51**). The authors find that tricalcium aluminate has no grouping which would justify its name. From the crystal structure it appears to be a mixed oxide and not a salt and is distinctly different from solid solutions or mix-crystals and also different from that of crystals containing complex ions. The original structure of neither oxide is retained in the case of tricalcium aluminate.

Classification by X-Rays of Asbestos

A RECENT issue of *Industrial and Engineering Chemistry* contains an illustrated report by H. V. Anderson and G. L. Clark of the University of Illinois on an x-ray examination of 30 different specimens of fibrous minerals from different parts of the world. Diffraction patterns were obtained for natural fibers and for the same fibers after digestion with concentrated hydrochloric acid and after ignition to constant weight at 900 deg. C.

The interpretation of the fiber diffraction patterns is included and the patterns of these minerals are reproduced. The attention is called to the difficulty of classification of fibrous silicates by usual optical, physical and chemical methods, and a method is suggested whereby classification of these minerals is greatly enhanced by precision measurements of the identity period and proper interpretation of the x-ray patterns.

The several theories advanced as to the origin of fibrous serpentine (chrysotile) are included, and a substantiation of the theory that there must have been a unidirectional force, pressure or tension applied to the material in contact with supersaturated solutions to bring about ultimate fibering. Reference is also made to the fact that x-ray photographs reveal the stage of metamorphism from the original country rock. The unit crystal cell dimensions for chrysotile are calculated from x-ray data to indicate a further precise method of comparison. Also the various facts are given to show wherein optical methods fail to divulge the most fundamental physical data, whereas x-ray analysis gives more valuable information.

Manufacture of Lime and Cement From Gypsum*

A Review of European Process Patents

By Otto Fr. Honus

THE methods of producing cement and lime should be adjusted in order to render production more profitable. Considering that the present production costs of these products are relatively high, it appears to be more economical to direct attention not exclusively to the main product, but also to possible by-products and waste products. The present situation of the cement industry, conditioned by the technical and economic progress, permits the use of raw gypsum instead of limestone. More attention has recently been given in Germany to the manufacture of hydraulic binding agents as cement with the recovery of sulphur compounds, since the manufacture of these products permits the country (Germany) to become independent of the pyrites (iron pyrites) now obtained from foreign countries. Further, the domestic gypsum deposits are being subjected to a more efficient and economic utilization.

Utilizing the Sulphur in Gypsum

The problem of manufacturing hydraulic binding agents from gypsum with a simultaneous recovery of sulphur compounds in some form is an old one, and has already been dealt with frequently. But only the more recent researches have made possible the production of a really good cement or lime plus a sufficiently concentrated sulphur dioxide. This latter can be used for sulphuric acid only when it has a minimum concentration of from 5 to 7% by volume. The methods which have been employed will be described here briefly.

The world war needs contributed principally to the search for a suitable process for utilizing the sulphur of the gypsum. O. F. Kaselitz describes a process (*Zeitschr. f. angew. Chemie.*, 1920, Bd. 33, I. S. 49) which is based upon the reduction of the gypsum to calcium sulphide, conversion of this to hydrogen sulphide, which is then burned to elementary sulphur. The process of manufacture is as follows: Anhydrite is crushed, mixed with dry pit coal and ground dry. The mixture of anhydrite and coal is heated in a rotary kiln continually at about 2012 deg. F. The calcium sulphide thus produced is ground, decomposed in an agitated vessel by the introduction of steam, and the resulting hydrogen sulphide collected in gasometers. This gas is passed to a mixing plant where the volume of air necessary for burning the H_2S is injected. The mixed gas is burned without excess air in contact ovens (Claus ovens); whereby the sulphur is eliminated according to the formula: $H_2S + O = H_2O + S$. The eliminated sulphur passes in molten state to a receiver; it solidifies in cooling pans. The sulphur so obtained is quite pure, averaging 99.95% S. Lime (CaO) results as a residue.

Conversion Process Yields a Pure Lime

According to the German Patent 307,772 (Chemische Fabriken, formerly Weiler-ter Meer, Uerdingen a. Rh.), calcium sulphide (CaS) is permitted to act upon calcium sulphate at temperatures 1832 deg. F., whereby decomposition occurs according to the formula: $3CaSO_4 + CaS = 4CaO + 4SO_2$. For example, a mixture of 87.8% gypsum and 12.2% calcium sulphide or 85% anhydrite and 15% CaS is heated to 1922-2102 deg. F. As the temperature increases there is an increasingly vigorous development of sulphur dioxide and this development continues until nearly all sulphur which is present in the form of sulphate and sulphide is expelled. The residue consists of almost pure lime.

By German Patents Nos. 307,043, 343,694, 349,346, 349,347 and 371,863 of the Metallbank und Metallurgische Ges., Frankfurt a. M., sulphuric acids are obtained besides lime by injection of a mixture of calcium sulphate and coal, or a mixture of alkaline earth sulphide and sulphate, to which are added sulphur-expelling sintering agents such as silicic acid and silicic-acid bearing artificial or natural substances, as, for example, sand, slag, boiler ashes and the like; furthermore iron oxide and iron-oxide bearing substances in such quantities that they can be decomposed by the surplus burning heat of the calcium sulphide. One of the processes proposes to convert the powdery mixture of calcium sulphide together with sintering agents into granular, spherical or other lump form, whereby burned gypsum is to be used as binding agent. The SO_2 content of the gases is 4 to 6%; the remainder being carbon dioxide, nitrogen and some SO_3.

In trying the processes described last, Bruno Waeser, Berlin, found, according to the German Patent 400,422, that a conversion can be effected much easier when the gypsum is not brought to a reaction with a sulphide, but is previously mixed with a hydrous solution of the hydrosulphide. A homogenous mixture of the insoluble sulphate and the soluble hydrosulphide can readily be prepared so that the mechanical features of the process becomes easier. In the case of gypsum, for example, a very pure lime is obtained with a splitting off of the entire quantity of sulphur dioxide at temperatures between 1652 and 1832 deg. F. The reaction occurs probably according to the equation: $Ca(SH)_2 + 6CaSO_4 = 7CaO + 8SO_2 + H_2O$.

Recovery of Pure Alkaline Earth Oxides

The recovery of pure alkaline earth oxides is the basis of German Patents Nos. 392,280 and 413,376 (A. G. f. Anilin-Fabrikation, Berlin-Treptow, inventors: Dr. A. Bibergeil and Dr. S. Muench). In this process sulphate of calcium, magnesium, barium or strontium is treated in quick cycles with reducing and oxidizing agents. The decomposition of magnesium sulphate occurs at about 1652 deg. F., whereas barium and strontium sulphates do not react until beyond 1832 deg. F.

The same method was followed in the German Patent No. 432,099 (Dr. Bambach and Co., Chemische Gessellschaft m.b.H., Frankfurt, a.M.) which, though issued later, had been applied for earlier. It likely has considerable advantages over the described processes, for its basis is thermo-technically simple without any additive compounds needed. In this case the combination of two well-known facts are used. First, there is the chemical decomposition of calcium sulphate at about 2552 deg. F. (H. O. Hoffmann and W. Mossowitsch, American Inst. Min. Eng., 1910, p. 917 and 1909. p. 219); and secondly, the invention of flameless surface burning. (Flameless surface burning is a new firing-technical process, the foundation for which was laid in 1908-1909 simultaneously and independently by Engineer R. Schnabel in Germany, Professor Bone in England and Professor Lucke in America.) If in the decomposition process by gas burning the air or oxygen supply with the reaction mass is withdrawn intermittently, completely or partly, sulphides are formed

*Zement (1929), 18, 37.

during the period of this withdrawal, which during the consequent supply of oxygen are decomposed again into oxides and sulphur dioxide: $CaSO_4 + 4CaO = CaS + 4CO_2$ and $CaS + 3O = CaO + SO_2$. In this case the sulphate is first heated and only enough gas supplied at first to produce burning without a flame. Finally, after the completed reaction, air is introduced, whereby the produced sulphide is decomposed into lime oxide and sulphur dioxide. With skillful management hydrous gypsum as well as anhydrite can be decomposed into calcium oxide of sufficient purity and concentrated sulphuric acid.

Van Denberg (U. S. Patent No. 642,390) obtains SO_3 besides lime by electrolysis of anhydrite in molten state and in presence of excess air. The SO_3 thus formed is hydrated to sulphuric acid.

Quantitative Reduction of Gypsum or Anhydrite

The German Petroleum A. G., Berlin (D.R.P. 319,651) proposes a reaction between gypsum or anhydrite with methane at temperatures between 1472 and 2372 deg. F. in order to obtain calcium sulphide. The reaction takes place according to the equation: $CaSO_4 + CH_4 = CaS + CO_2 + 2H_2O$. The rapidity of the reaction is dependent on the temperature and the pressure of the natural gas, and the reaction temperature conversely depends upon the speed the natural gas is passed through the reaction mixture. If the temperature goes over the limit of 2372 deg. F., elimination of carbon takes place according to the equation: $CaSO_4 + 2CH_4 = CaS + 2C + 4H_2O$. The natural gas (methane) is passed over the finely pulverized calcium sulphate, or the sulphate is moved in rotating kilns towards the gas flow.

These processes are not in harmony with the investigations of E. H. Riesenfeld and M. Hesse (*Journ. f. prakt. Chemie,* 1920, **100,** pp. 115, 116, 135, 142, 146, 154 and 157). These latter found in a number of tests that the quantitative reduction of calcium sulphate by methane to calcium sulphide at temperatures between 1472 and 2012 deg. F. is possible only after a sufficiently long period of action. Their tests show that a portion of the calcium sulphide is converted into calcium oxide at 2012 deg. F., whereas the equivalent quantity of sulphur escapes in gaseous state. At temperatures above 2192 deg. F. an elimination of carbon takes place simultaneously, obviously originating from the decomposition of the methane as it is passed through the mass. Sulphur is expelled more completely from the reaction material as the excess of steam is increased. The following four reactions take place in a simultaneous action of methane and steam upon calcium sulphate at temperatures above 1832 deg. F.:

$$CaSO_4 + CH_4 = CaS + CO_2 + 2H_2O$$
$$CaSO_4 + CH_4 = CaO + CO_2 + H_2S + H_2O$$
$$CaSO_4 + CH_4 = CaO + CO_2 + S + H_2O + H_2$$
$$CaSO_4 + CH_4 + H_2O = CaO + CO_2 + SO_2 + 3H_2O$$

In collaboration with A. Faber, Riesenfeld has investigated the reduction of pyrites with coal (*Journ. f. prakt. Chemie,* 1920, **100**). A temperature of 1562 to 1742 deg. F. was found to be most favorable and a mixture of magnesium sulphate and coal in the molecular relation 1:1 and 1:1.5 was found to be most suitable. Under such conditions magnesium sulphate is reduced quantitatively to magnesium oxide, whereby about 98% of the sulphur escapes as gaseous sulphuric dioxide.

Action of Steam

Tilghmann (*Dinglers Polyt. Journ.,* **106,** p. 196, 1847) suggests passing steam over calcining gypsum; lime, SO_2, oxygen and some sulphuric trioxide are said to result.

The investigations of Budnikoff and Wosnessensky made along these lines showed that only a slight reaction sets in at 1832 deg. F. Only a small quantity (3.9%) of CaO could be determined in the decomposition products. In the absence of carbon or silicates, water apparently does not bring about split changes in the products of calcium sulphate. Riesenfeld, investigating the action of steam upon a mixture of gypsum and coal, determined that at 2192 to 2372 deg. F. there is formed independent of the quantity of steam 23.6 to 41.8% SO_2, 69.3 to 57.4% S and 7.1 to 0.8% H_2S. Czechoslovakian Patent Application P/4832/25 (*Stavivo,* 1927, p. 53) proposes the decomposition of gypsum in a mixture of silicic acid or of substances high in silicic acid, with steam suitably in an oxidizing atmosphere at 2012 deg. F. or higher temperatures. Thus hydraulic lime besides sulphuric acid is supposed to be obtained.

Cement and Sulphuric Acid from Gypsum

The processes sketched briefly above deal principally with the recovery of pure alkaline earth oxides, particularly lime alone or in combination with silicic acid (strong hydraulic limes) and sulphur compounds. In the following section a brief description of the processes which deal with the manufacture of cement and sulphuric acid from gypsum is given.

Cummings' patent (U. S. No. 342,785) and Lacke's patent (British Patent No. 7355) represent processes which could not attain economical importance. In this process a mixture of gypsum and clay is subjected to calcination in a shaft kiln, to produce a hydraulic cement. The SO_3 and SO_2 driven off are to converted by usual method into sulphuric acid. Test of this process has shown that the cement obtained is usable; but that the production of sulphuric acid with diluted gases, such as are obtained in this process, does not work well.

The German Patents 300,849 and 388,849 (1919) of the former Friedr. Bayer and Co., Leverkusen, require special mention. According to them a mixture of gypsum with silicic acid and silicate of alumina and less than the theoretically required quantity of coal is burned to the sintering point in an ordinary rotary kiln of 164 ft. length and 8.2 ft. diameter at 2642 deg. F. and in a slightly oxidizing air current. The conditions which must be maintained in order to obtain a high grade cement and pure sufficiently concentrated (6 to 7% by volume) SO_2 gas for the production of sulphuric acid by the lead chamber process or the contact process are as follows: 1. The kiln must be charged with a mix as fine and dry as possible; 2. The kiln gases must be slightly oxidizing, since in reducing operations carbonyl sulphide (COS) appears in the gases, and calcium sulphide (CaS) appears in the clinkers; 3. The coal content corresponding to the equation $CaSO_4 + C = CaO + SO_2 + SO$ is unfavorable for regulated kiln burning, for a too great reducing action occurs and the mix is brought to fusion instead of sintering. The fusion of the burning material in the kiln causes the annoying "ring" formation. In order to eliminate "ringing" the use of only one-half of the given theoretical quantity of coal, somewhat according to the equation: $2CaSO_4 + C = 2CaO + 2SO_2 + CO_2$ is recommended. This procedure with a small excess of oxygen gives satisfactory results with respect to burning of the clinker and gas concentration as well as good purity of the SO_2 gases. Coke is used as reducing agent, and this is added in finely ground and dry condition to the raw mix. The chemical composition of the end-product of the calcination corresponds to the normal portland cement with a hydraulic modulus = 2 and a silica modulus = 2. The cement obtained in this manner attains after 6 days of storage in water a compressive strength of 417 kg./cm.^{2}, after 27 days' storage in water 513 kg./cm.^{2}, and after 27 days of combined storage 606 kg./cm.^{2}. The portland cement is worked up into blast furnace with blast furnace slag in proportions of 30:70. This cement sets in 5 to 8 hours and shows very good compressive strengths, not below 406 and up to 565 kg./cm.^{2} after 27 days' combined storage.

Hydraulic Limes Possible

According to the process of Lucien Paul Basset, France (German Patents 324,570 and 339,174), hydraulic lime or cement is obtained in the following manner: An intimate mixture of gypsum, clay and coal is passed through a rotary kiln either dry or as a slurry. In this kiln are produced two burning zones, one reducing calcining zone in which an excess of calcium sulphide is formed, and an oxidizing burning zone for the complete disintegration by oxidation of the formed calcium sulphide. In order to make the conversion as complete as possible steam is passed through the heated mixture.

To obtain cement, gypsum is first heated with an excess of clay; then the intermediate product with the remaining lime, which is theoretically required for obtaining the desired cement, is added. Finally the material is burned again.

Natho (Italian Patent 413,166) mixes finely powdered burned gypsum and clay, keeping the relation between $SiO_2 + Al_2O_3 + Fe_2O_3$ to CaO, 0.43 and 0.50. With a little water this mixture is pressed into bricks which are then heated in kilns in such a manner that the coal does not come in direct contact with the material and a large excess of air is present. At 1832 deg. F. there develops $CaSiO_3$, at 2642 deg. F., $CaO + SO_3$, at 2912 deg. F. $Ca_5Si_2O_9$. In addition, calcium aluminate and calcium ferrite are formed, and the resulting slags represent a correct portland cement. The gases escaping from the kiln at 932 deg. F. are used for dehydrating the gypsum at 311 deg. F. before they pass into the sulphuric acid apparatus.

P. Baud (Comptes rend. 1927, p. 1140) treats a mixture of 400 g. pulverized gypsum, 350 cc. aqueous ammonia (0.89 sp. gr.), 70 g. clay and 600 cc. water in a 5 liter agitated autoclave with subsequent introduction of CO_2 at 0.75 at. (10.7 lb.) maximum pressure and at a temperature of 158 to 118 deg. F. for 40 minutes. This yields a 28% solution of ammonium sulphate solution and sulphur of 96.6% purity. The clay and limestone sludge is said to make a good portland cement, burned at 2822 to 2912 deg.F.

Complete Elimination of Sulphuric Acid a Problem

The complete elimination of the remaining sulphuric acid from the gypsum cannot always be accomplished without difficulties, and this condition is always involved, more or less, in the technical solution of this problem. The Rekordzementindustrie G.m.b.H. (D.R.P. 380,621) suggested for use in the elimination of the remainder of sulphate from the raw cement mass prepared from gypsum, or from the burned gypsum, compounds of Ba, Sr or Pb for fixing the sulphate; thereby the unsoundness of the cement due to excessive gypsum content is prevented.

As can be seen from the above, there is no longer lacking a process for the rational production of lime, hydraulic lime and portland cement and also sulphur compounds. By contrasting these processes with those for the limes and cements produced from limestone only or from a combination with siliceous substances which must also be burned and therefore require nearly just as much heat energy, it becomes evident that the processes for gypsum, lime, cement and sulphur production signify not only a technical but also an economical progress.

Examples were given in the above paragraphs for the use of the sulphur as a by-product in the manufacture of lime and cement. The following are other methods which could come under consideration for the cement and lime industry, for they are distinguished by the use of carbonic acid gas which could be taken from the waste gases of the cement and lime industry, and also they yield carbonate of lime in such a form that it is suitable for raw mixes without being ground previously—or, pressed into brick and burned, could be worked into lime.

Processes Involving Use of CO_2

According to the French Patent 331,897 of L. P. Basset, gypsum with coal and tar, shaped into lumps, is heated in a retort. The resulting calcium sulphide is disintegrated with carbonic acid and the liberated H_2S burned; then the SO_2 formed in the burning is converted to sulphuric acid by the customary methods. Carbonate of lime remains as a residue.

Koehsel decomposes gypsum by means of coal, treats the resulting CaS with CO_2 and passes the SO_2 gases into lead chambers.

Claus, Baranoff and Hildt (German Patent No. 104,186) heat gypsum with coal in retorts, obtaining gases from the reaction $CaSO_4 + 2C = CaS + 2CO_2$, which contain up to 90% CO_2. These gases are permitted to act upon CaS in presence of water, so that $CaCO_3$ and H_2S result. $CaS + H_2O + CO_2 = CaCO_3 + H_2S$. The H_2S is passed into retorts, which contain anhydrous $CaSO_4$ and which are heated to a red heat. The first reaction is: $3CaSO_4 + 4H_2S = 3CaS + 4H_2O + 4SO_2$. But if there is an excess of H_2S, this acts upon SO_2 and free sulphur forms by the Dumasch reaction: $SO_2 + 2H_2S = 2H_2O + 3S$.

An improved Claus-Baronoff-Holdt modification is probably represented by the process of Dr. Bambach and Co. (German Patent No. 371,978) in which the calcium sulphide obtained from $CaSO_4$ by reduction is converted into CaO and hydrogen sulphide by aid of suitable volumes of steam introduced below the reaction zone, and in which the hydrogen sulphide is oxidized on its way through the gypsum kiln to SO_2. A shaft kiln which is provided with a number of nozzles at different elevations is used to evade the burdensome sulphur formation

Cheaper Aluminous Cements

The high production costs of alumina cement, using high-alumina bauxite as raw material, has led to attempts to produce aluminous or fused cement from cheaper raw materials. In fact, this has been made possible to a certain extent, and several processes are being employed in which fused cement is produced without bauxite. As a rule, abundantly available quantities of aluminum-bearing substances, such as clay, residues in nitrogen production from aluminum nitride, bog iron ore, strongly iron and aluminum bearing limes and also fuel wastes of different kinds, such as brown coal—pit coal ashes and coke slag are used as substitutes for bauxite.

German Patent No. 407,373 makes use of valueless iron bearing waste materials, such as bog iron ore, iron bearing limes, clay slate and also fuels high in iron. They are mixed with each other in such a way that the relation

$$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3} = 0.8 - 1.2.$$

In consequence, the mixed product after fusion produces a cement of the following composition: 11 to 20% SiO_2, 16 to 33% Fe_2O_3, 8 to 16% Al_2O_3 and 45 to 55% CaO. This analysis shows that the alumina has been replaced to a great extent by iron oxide.

Another process, German Patent No. 409,665, increases the temperature in a coke gas generator, which is used for producing coke gas, by excess oxygen added to the blast. This is done so that to the coke-slag residue the corresponding quantity of lime or high-lime material can be added to give the molten slag a CaO content of from 40 to 60% and a quantity of alumina which is more than silica content. The increase in temperature in the generator is obtained by increasing the oxygen content of the blast from 21 to 24% by admixing "Linde" air. The charge comprises 442 kg. coke, to which is added 12 kg. of granulated gas generator slag and 27 kg. of lime. The fused cement thus obtained has a specific gravity of 3.1, and about the following composition: 10.8% SiO_2, 4.4% Fe_2O_3, 40.7% Al_2O_3, 42.8% CaO, 1.5% S, 0.30% SO_2, traces of SO_3. Physical standards of this cement are favorable. The tensile strength of the 1:3 specimen is 19.6 kg./cm.[2] after 24 hours, 28.8 after 7 days, 40.3 after 28 days; and the compressive strength 258-after 24 hours, 298-after 7 days and 346 kg./cm.[2] after 28 days.

Use of High-Iron Materials

Natho refers to the ash-alumina cements in *Tonindustrie-Zeitung* (1925), 2, p. 29. He starts with Rhineland brown coal ashes of the following composition: 43.21% combustible, 1.59% SiO_2 18.72% $Al_2O_3 + Fe_2O_3$, 24.41% lime, 3.38% MgO. If 46.77 parts of a mixture of silica and alumina (the mixture analyzes 21.4% SiO_2 and 76.6% Al_2O_3) are added to 100 parts of this substance, cement of the following composition results: 9.16% SiO_2, 50.9% $Fe_2O_3 + Al_2O_3$, 34.9% CaO, 5.04% MgO. This cement comes quite close to the French fused alumina cement. When using kaolin the bauxite addition reaches minimum limits. It is difficult, however, to obtain uniform products since the Rhineland brown coal ashes vary much in their composition. Another obstacle is the high iron content which acts so that a mixture of aluminate cement or ferrate and ferrite cements is produced.

G. Agde and R. Klemm (*Zeitschr. f. angew. Chemie*, 1926, 6, S. 175) experimented with Vogelsberger bauxite of high iron content. They attempted to convert the iron oxide into metallic iron by reduction with coke; the metallic iron was then removed

with a magnet. However, the cement did not give the desired strengths. Its composition was 19.20% SiO_2, 0.92% FeO, 45.53% CaO, 10.79% Fe_2O_3 and 23.02% Al_2O_3. The compressive strengths were 117 kg./cm.^{2} after 3 days, 166 after 7 days, 186 after 14 days and 194 after 28 days.

Fused Cements

More favorable results were obtained with fused cements produced from gypsum. According to German Patent No. 310,070 (Friedr. Bayer and Co., Leverkusen), sulphate of lime is heated with silica, alumina —and other iron oxide bearing admixtures in which the iron oxide exceeds or replaces the content of aluminum oxide to a sinter or fusion. For example, 1 part of roasted pyrites, 2.25 of sand and 13 of anhydrite are mixed, ground, heated either as a slurry or a powder in the rotary kiln or as a briquette in the shaft kiln to fusion, then cooled rapidly and eventually granulated. The SO_2 gases escaping in this process are converted to sulphuric acid. The fusion product represents by no means an alumina cement, but in its being and its composition must be considered a fused portland cement in which the iron oxide exceeds the alumina.

A process which may attain importance for the production of alumina cement and the simultaneous production of sulphuric acid is that of G. Polysius, Dresden (German Patent No. 416,592). Gypsum is used here instead of lime or limestone and the sulphuric acid content driven out completely by the addition of high-alumina bauxite.

According to the German Patent No. 437,-242 (Friedr. Krupp-Grusonwerke, Magdeburg), alumina cement is produced as follows: In order to obtain the quantity of alumina and silicic acid required for obtaining a correct alumina cement, the silicic acid content of aluminum silicates high in silica is changed by the use of fluorspar and sulphuric acid into a volatile form. Alumina and calcium sulphate are formed by the removal of the silicic acid; these are then processed in customary manner into alumina cement with recovery of the sulphuric acid. Furthermore, fluo-silicic acid is obtained here as a by-product. The process excludes the use of high-alumina bauxite.

Melting Down of Gypsum

O. F. Honus suggests in Czechoslovakian Patent 23,829 to melt gypsum high in alumina in an electric furnace with bituminous shale, bog iron ore, clay or slate clay, as also residues of the manufacture of sodium sulphide. When using a gypsum of 22.76% Al_2O_3 content and bituminous or coal-bearing shale, a fused cement of the following composition is obtained: 11.05% SiO_2, 39.90% CaO, 42% Al_2O_3 + Fe_2O_3, 1.75% MgO and 3.10% $CaSO_4$. Sulphuric acid is a byproduct.

E. Schott of Heidelberg (German Patent No. 73,285) obtains an alumina cement and sulphuric acid by melting down of anhydrite or gypsum without addition of silica. Barium sulphate can be used also.

In Czechoslovakian Patent 24,765, Honus attempts to produce a mixed cement high in alumina and in which the lime is partly replaced by barium oxide. Sulphuric acid is obtained as by-product. The alumina cement so made is distinguished by the use of gypsum high in alumina, and barium compounds containing sulphur. Depending on the mixing relation, the chemical composition can fluctuate between 15.2 to 18.3% SiO_2, 33.4 to 37.3% Al_2O_3 + Fe_2O_3, 24.60 to 29.60% BaO and 22.93 to 15.50% CaO.

A number of processes have thus been described in which lime, hydraulic lime, cement, fused cement and alumina cement is obtained. In most instances the raw materials consist of sulphates of the alkaline earths. The economy of the hydraulic cement industry can be increased by the recovery of sulphur compounds as byproducts.

Notes on Plaster of Paris

IN the February 1929 issue of the *Journal of the Indian Ceramic Society*, 899 Sadashiv Peth, Poona, No. 2, appears tabulated results on the absorption rates of set gypsum plaster. The work was undertaken by S. M. Marathe and A. D. Joshi in an endeavor to save gypsum molds from destruction due to internal pressures developed by internal stresses set up from the crystallization of soluble sodium salts that are preumably used as an accelerator for the setting plaster of paris. Why raw gypsum, which is a better accelerator, is not used instead of soluble sodium salts is not stated.

The tests bring out the fact that porosity and absorbing power of plaster of paris vary directly as the amount of water added for mixing and that strength varies inversely as the water added.

Rate of Burning of Individual Particles of Solid Fuel

A RECENT article in *Industrial and Chemical Engineering* describes an apparatus and method for determining the rate of burning of individual particles of solid fuels under controllable conditions of furnace temperature, particle size and oxygen concentration.

In this article are discussed typical data for three sizes of coal and two sizes of semi-coke and active charcoal. The conclusions drawn are: *(a)* Under the experimental conditions, fuels containing high percentages of volatile matter show a pronounced increase in burning time with increasing furnace temperature; *(b)* fuels containing practically no volatile matter show a much smaller temperature coefficient over the temperature range covered in the experiments; and *(c)* active charcoal requires a considerably longer period to burn than coal or semi-coke of the same size (weight per particle).

Development of the Gypsum Industry

THE UNITED STATES DEPARTMENT OF COMMERCE, Bureau of Mines, has issued Information Circular No. 6173 by R. M. Santmeyers, mineral specialist of the Bureau, entitled, "Development of the Domestic Gypsum Industry by States."

The report gives the production and sales of gypsum by states from 1890 to 1927, inclusive, as well as considerable data of historical nature regarding the industry in the different producing states. The industry in each state is treated separately giving production statistics and a brief history of the earlier operating companies which pioneered the industry in those sections.

The booklet is interesting solely from a historical angle. Its accuracy as far as present operations are concerned is questionable. We make this assertion by reference to the chapter covering California wherein several companies long extinct are mentioned but with such producing companies as the Pacific Portland Cement Co., with a plant at Plaster City, the United States Gypsum Co., with a plant at Blythe and the Blue Diamond Co., with a plant in Los Angeles not even mentioned as operating in that state.

The reference to the "high grade" deposits near Palmdale are also misleading; the Palmdale deposits are, on the contrary, extremely low grade, in fact they have so low a gypsum content that the material does not comply with the State of California's requirements for land plaster even. The deposits are more of a gypsite with a low gypsum content with thin bands of gypsum cutting through gypsite beds.

It is a bit hazy just what information the circular is supposed to convey. If it is a history of companies which have gone out of business for one reason or another there is nothing further to be said, but if it is intended as a statistical compilation of present producing companies its accuracy is surely open to question.

It is apparent that compilations of this nature even under the auspices of the United States Government cannot be maintained to a high degree of accuracy without extensive traveling on the part of the compiler; and sufficient funds should be made available for the Bureau of Mines so its staff can gather first-hand information regarding the gypsum and other rock products industries if such reports are to be of much practical value.

Gypsum Products in 1927

A PRELIMINARY report for this industry for 1927 was issued under date of January 30, 1929, and published in statistical form in the May 11, 1929, issue of ROCK PRODUCTS. The final report issued by the Bureau of the Census, Department of Commerce, covering wall plasters, wallboard and floor composition is now available at the United States Printing Office. Price, 5c.

Increasing the Output of Tube and Compound Mills

By Th. Trampe
Shanghai Portland Cement Works, Lunghwa, China

A FEW facts from practical operation will be given here concerning milling transactions and increasing the output of tube and compound mills.

Case I

In the first place, the rate of fineness and the output of the raw materials mill are to be improved. The mill in use has three chambers and is 13 m. (43 ft.) long and 2 m. (6.6 ft.) in diameter. The first and second chamber have steel plates, the third has silex stone. The mill is filled as follows, according to the manufacturers:

CHAMBER I	CHAMBER II	CHAMBER III
3 tons balls of 110 *mm. dia.	3 tons balls of 70 mm. dia.	9 tons of flint pebbles of 40-60 mm. dia.
2 tons balls of 100 mm. dia.	3 tons balls of 60 mm. dia.	6 tons of flint pebbles of 20-40 mm. dia.
2 tons balls of 90 mm. dia.	3 tons balls of 50 mm. dia.	
1 ton balls of 80 mm. dia.		

* 1 mm. = 0.04 in.

The average 24-hr. output of the mill is 300 tons of material with a sieve as follows: Residues of 0.9% on the 900-mesh metric (76-mesh) sieve, and 10% on the 4900-mesh (178-mesh) sieve. The power required is 380 amp. at 525 v. or 267 hp.

The mill was filled with special balls furnished by Kordt and Rosch Co., which guaranteed an increase in output of 25-30% at a rate of fineness of 8% on the 4900-mesh (178-mesh) sieve. Table I gives the data on this test.

To operate the mill in accordance with the statements of Kordt and Rosch was not possible. The mill load was too small, but far too high for the motor, for the temperature determined on the windings of the motor was 80 deg. C. (176 deg. F.) at a room temperature of 30 deg. C. (86 deg. F.). The mill was refilled and the above output obtained as given in Table I. The maximum output of the mill is now 480 tons per 24 hours.

Case II

In the second instance the coal mill was to be made more efficient as regards output in fine grinding and quantity. This mill is of the double compartment type with exterior sieves and with a return for the coarse particles to the first chamber. The mill is 8 m. (26 ft.) long and 1.6 m. (5.2 ft.) in dia. The first chamber is lined with steel plates and the second has a Silex lining. The daily requirements of pulverized coal at the plant is 60 tons. In order to see if the

TABLE II. COAL MILL

Test	COMP. I	COMPARTMENT II
TEST I (Filling and Output According to Manufacturer)	1.0 t. balls 90 mm.	3.7 t. flint pebbles 40-60 mm.
	1.5 t. balls 80 mm.	3.7 t. flint pebbles 20-40 mm.
	1.5 t. balls 70 mm.	
	1.5 t. balls 60 mm.	
	1.5 t. balls 50 mm.	
TEST II	2.5 t. balls 80 mm.	3.7 t. flint pebbles 40-60 mm.
	1.5 t. balls 70 mm.	3.7 t. flint pebbles 20-40 mm.
	1.5 t. balls 60 mm.	
TEST III	1.5 t. balls 80 mm.	3.7 t. flint pebbles 40-60 mm.
	1.5 t. balls 70 mm.	3.7 t. flint pebbles 20-40 mm.
	1.5 t. balls 60 mm.	
	1.5 t. balls 50 mm.	
TEST IV	1.5 t. balls 80 mm.	7.5 t. "Cylpebs" 25x35 mm.
	1.5 t. balls 70 mm.	
	1.5 t. balls 60 mm.	
	1.5 t. balls 50 mm.	
TEST V	1.5 t. balls 80 mm.	3.7 t. "Cylpebs" 25x35 mm.
	1.5 t. balls 70 mm.	3.7 t. "Cylpebs" 32x50 mm.
	1.5 t. balls 60 mm.	
	1.5 t. balls 50 mm.	
TEST VI	1.5 t. balls 80 mm.	3.7 t. balls 30 mm.
	1.5 t. balls 70 mm.	3.7 t. balls 25 mm.
	1.5 t. balls 60 mm.	
	1.5 t. balls 50 mm.	
TEST VII	1.5 t. balls 80 mm.	4 t. "Concavex" 25x35 mm.
	1.5 t. balls 70 mm.	2 t. "Cylpebs" 25x35 mm.
	1.5 t. balls 60 mm.	2 t. "Cylpebs" 32x50 mm.
	1.5 t. balls 50 mm.	
TEST VIII	1.5 t. balls 80 mm.	4 t. "Concavex" 25x35 mm.
	1.5 t. balls 70 mm.	2 t. "Cylpebs" 25x35 mm.
	1.5 t. balls 60 mm.	2 t. "Cylpebs" 32x50 mm.
	1.5 t. balls 50 mm.	

TABLE I. RAW GRINDING MILL

Filling	COMPARTMENT I	COMPARTMENT II	COMPARTMENT III
FILLING ACCORDING TO KORDT AND ROSCH	3 t. balls 100 mm. dia.	2.5 t. balls 70 mm. dia.	10.5 t. cubes 25 mm. dia.
	2 t. balls 90 mm. dia.	2.5 t. balls 60 mm. dia.	1.5 t. balls 25 mm. dia.
	1 t. balls 80 mm. dia.	4.0 t. balls 50 mm. dia.	
	2 t. balls 70 mm. dia.		
FIRST REFILLING	5 t. balls 100 mm. dia.	2.5 t. balls 70 mm. dia.	10.5 t. cubes 25 mm. dia.
	2 t. balls 90 mm. dia.	2.5 t. balls 60 mm. dia.	1.5 t. balls 25 mm. dia.
	1 t. balls 80 mm. dia.	4.0 t. balls 50 mm. dia.	
	2 t. balls 70 mm. dia.		
SECOND REFILLING	2 t. balls 110 mm. dia.	2.5 t. balls 70 mm. dia.	10.5 t. cubes 25 mm. dia.
	5 t. balls 100 mm. dia.	2.5 t. balls 60 mm. dia.	1.5 t. balls 25 mm. dia.
	2 t. balls 90 mm. dia.	4.0 t. balls 50 mm. dia.	
	1 t. balls 80 mm. dia.		
THIRD REFILLING	2 t. balls 110 mm. dia.	3.5 t. balls 70 mm. dia.	10.5 t. cubes 25 mm. dia.
	5 t. balls 100 mm. dia.	2.5 t. balls 60 mm. dia.	1.5 t. balls 25 mm. dia.
	2 t. balls 90 mm. dia.	4.0 t. balls 50 mm. dia.	
	1 t. balls 80 mm. dia.		

TABLE III. CEMENT MILL

Test	COMP. I	COMP. II	COMP. III
TEST I	1 t. balls 100 mm.	5 t. balls 60 mm.	5 t. "Cylpebs" 25x40 mm.
	3 t. balls 90 mm.	2 t. balls 50 mm.	5 t. "Cylpebs" 32x50 mm.
	3 t. balls 80 mm.	1 t. balls 40-50 mm.	
	3 t. balls 70 mm.		
TEST II	1 t. balls 100 mm.	5 t. balls 60 mm.	5 t. cast balls 30 mm.
	3 t. balls 90 mm.	2 t. balls 50 mm.	5 t. cast balls 20 mm.
	3 t. balls 80 mm.	1 t. balls 40-50 mm.	
	3 t. balls 70 mm.		
TEST III	1 t. balls 100 mm.	2 t. balls 60 mm.	5 t. cast balls 30 mm.
	3 t. balls 90 mm.	5 t. balls 50 mm.	5 t. cast balls 20 mm.
	3 t. balls 80 mm.	1 t. balls 40-50 mm.	
	2 t. balls 70 mm.		
	1 t. balls 60 mm.		
TEST IV	1 t. balls 100 mm.	4 t. "Cylpebs" 25x40 mm.	5 t. cast balls 30 mm.
	3 t. balls 90 mm.	4 t. "Cylpebs" 32x50 mm.	5 t. cast balls 20 mm.
	3 t. balls 80 mm.		
	2 t. balls 70 mm.		
	1 t. balls 60 mm.		
TEST V	1 t. balls 100 mm.	4 t. "Cylpebs" 25x40 mm.	5 t. flint pebbles 40-60 mm.
	3 t. balls 90 mm.	4 t. "Cylpebs" 32x50 mm.	5 t. flint pebbles 20-40 mm.
	3 t. balls 80 mm.		
	2 t. balls 70 mm.		
	1 t. balls 60 mm.		
TEST VI	1 t. balls 100 mm.	4 t. "Cylpebs" 25x40 mm.	10 t. flint pebbles 20-40 mm.
	3 t. balls 90 mm.	4 t. "Cylpebs" 32x50 mm.	
	3 t. balls 80 mm.		
	2 t. balls 70 mm.		
	1 t. balls 60 mm.		
TEST VII	1 t. balls 100 mm.	2 t. cubes 60 mm.	10 t. flint pebbles 20-40 mm.
	3 t. balls 90 mm.	4 t. cubes 50 mm.	
	3 t. balls 80 mm.	2 t. cubes 40 mm.	
	2 t. balls 70 mm.		
	1 t. balls 60 mm.		
TEST VIII	1 t. balls 100 mm.	2 t. cubes 60 mm.	5 t. cast balls 30 mm.
	3 t. balls 90 mm.	4 t. cubes 50 mm.	5 t. cast balls 20 mm.
	3 t. balls 80 mm.	2 t. cubes 40 mm.	
	2 t. balls 70 mm.		
	1 t. balls 60 mm.		
TEST IX	1 t. balls 100 mm.	1 t. balls 60 mm.	5 t. cast balls 30 mm.
	3 t. balls 90 mm.	3.5 t. balls 50 mm.	5 t. cast balls 20 mm.
	3 t. balls 80 mm.	3.5 t. balls 40 mm.	
	2 t. balls 70 mm.		
	1 t. balls 60 mm.		
TEST X	1 t. balls 100 mm.	1 t. balls 60 mm.	5 t. steel balls 30 mm.
	3 t. balls 90 mm.	3.5 t. balls 50 mm.	5 t. steel balls 20 mm.
	3 t. balls 80 mm.	3.5 t. balls 40 mm.	
	2 t. balls 70 mm.		
	1 t. balls 60 mm.		

existing coal mill was of sufficient capacity to supply the increases demanded by the enlargements of the kilns the following tests on increase in output were made as given in Table II.

After improvement of the raw grinding and the coal mills the kiln output was raised from 1250 to 1350 bbl. of clinker per 24 hr.

Case III

In this case the finished cement mill was also to be raised to the maximum output. The mill has two chambers, with exterior sieves and return of the coarse particles to the first chamber. The first chamber is lined with steel plates and the second chamber with Silex. Its length is 11 m. (36 ft.) and diameter 2 m. (6.6 ft.). According to the manufacturer, the filling and output is as follows:

COMPARTMENT I Dia.	COMPARTMENT II Dia.
0.5 ton balls 100 mm.	7 tons flint pebbles 40-60 mm.
2 tons balls 90 mm.	7 tons flint pebbles 20-40 mm.
3 tons balls 80 mm.	
3 tons balls 70 mm.	
2 tons balls 60 mm.	

Power requirement, 380 amp., 525 v. or	267 hp.
Residue on 76-mesh sieve	1.5%
Residue on 178-mesh sieve	15%
Output in barrels per 24 hours	1200

After the fineness requirements were improved the output of the mill dropped to 1050 bbl. per 24 hr. The first filling for increasing this output was as follows:

COMPARTMENT I	COMPARTMENT II
0.5 ton balls 100 mm.	7 tons Cylpebs of 25x35 mm.
2 tons balls 90 mm.	7 tons Cylpebs of 18x30 mm.
3 tons balls 90 mm.	
3 tons balls 70 mm.	
2 tons balls 60 mm.	

Power requirement, 420 amp., 525 v. or	323 hp.
Residue on 76-mesh sieve	0.4%
Residue on 178-mesh sieve	13%
Output in barrels per 24 hours	1350

The mill was then rebuilt into a three-compartment type, the first chamber being 2.5 m. (8.2 ft.) long, the second 2 m. (6.6 ft.) and the third, 6 m. (19.7 ft.). The first and second compartments have steel plates lining and the third chamber, a Silex lining. The filling of the rebuilt mill is as follows:

COMP. I	COMP. II	COMP. III
1 t. balls 100 mm.	1 t. balls 60 mm.	5 t. balls 30 mm.
3 t. balls 90 mm.	3.5 t. balls 50 mm.	5 t. balls 20 mm.
3 t. balls 80 mm.	3.5 t. balls 40 mm.	
2 t. balls 70 mm.		
1 t. balls 60 mm.		

Since the balls needed for filling the rebuilt mill were not yet at the cement plant, milling tests for increasing output were conducted with the balls available as given in Table III. Later tests will have to show whether it is possible to increase output further with the special balls following these good results.

RESULTS OF TESTS (TABLE I), RAW GRINDING MILL

	Filling: Original	First	Second	Third
Power requirement in amp., 525 v.	430	420	410	400
Residue, 76-mesh sieve, per cent	0.3	0.3	0.4	0.2
Residue, 178-mesh sieve, per cent	4.0	5.0	6.5	4.5
Output in tons per 24 hours	250	350	400	420

RESULTS OF TESTS (TABLE II), COAL MILL

	Test No.							
	I	II	III	IV	V	VI	VII	VIII
Residue on 76-mesh sieve, Comp. I, %	16	13	10	9.7	10.2	10	9.2	8
Residue on 178-mesh sieve, Comp. I, %	32	31	25	25.4	25.9	24	24.7	22
Power required in amp., 525 v.	160	160	162	200	190	190	180	180
Residue, 76-mesh sieve, %	0.9	0.7	0.4	0.4	0.8	0.7	0.4	0.2
Residue, 178-mesh sieve, %	11	10	9.2	9	12	10.4	9.2	6.4
Output in tons, per 24 hr.	60	60	60	60	55	52	80	60
Power required, in hp.	117	117	118	146	139	139	131	131

RESULTS OF TESTS (TABLE III), FINISH GRINDING MILL

	Test No.									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Residues, Comp. I										
76-mesh sieve, %	44	......	40.5	......	......	......	......	......	......	......
178-mesh sieve, %	63	......	59	......	......	......	......	......	......	......
Residues, Comp. II										
76-mesh sieve, %	15.3	......	11.5	4.3	......	......	10.7	......	12.2	......
178-mesh sieve, %	38.5	......	36	29	......	......	32.2	......	32.7	......
Residues, Comp. III										
76-mesh sieve, %	0.4	0.5	0.5	0.3	0.8	1	1.5	0.6	0.4	0.3
178-mesh sieve, %	13.5	14	13	13	13	13	13	13.5	13.5	13
Power, in amp., 525 v.	460	420	430	445	425	440	450	440	420	420
Output, bbl., 24 hr.	1450	1350	1400	1350	1250	1350	1375	1350	1400	1550
Power required, in hp.	336	307	314	325	311	321	328	321	307	307

Mining and Milling of Asbestos

MINING METHODS in the asbestos industry vary according to the geological occurrence of the asbestos, says the United States Bureau of Mines, Department of Commerce, in a report recently issued. The asbestos in limestone, such as the deposits in Arizona, is usually mined by tunnels and lateral drifts, or by some simple system of underground mining following the ore. In the Arizona field the ore is first blocked out and then stoped, the roof, after stoping, being upheld by the waste rock. In this field it is common practice to keep the roof close to the asbestos zone and to pick down the ore onto a large canvas after the supporting rock has been removed.

Asbestos in peridotite or large masses of serpentine is generally mined by open pit, as in Canada. After the rock is blasted it is sorted and cobbed, all fiber ¾-in. long and over being bagged as crude No. 1, corresponding fiber ⅜- to ¾-in. in length being bagged as crude No. 2. The mill fiber, or fiber shorter than ⅜-in., is separated from the crushed rock by pneumatic and screening processes.

Crude fiber is usually graded by hand-cobbing and sorting, though sometimes the poorer material is screened. The very short fiber that forms the great bulk of the world's production is separated by milling. Mill fiber is graded largely on the basis of screen tests. Screens of 2, 4 and 10 meshes to the inch are used. Sixteen ounces of fiber are taken, and the amounts retained on each screen and that which passes through the last one is recorded after the screens have been shaken in a specified manner for two minutes. Thus 1-8-5-2 would indicate that 1 oz. remained on the 2-mesh screen, 8 oz. on the 4-mesh and 5 oz. on the 10-mesh, and that 2 oz. passed through the 10-mesh screen.

The volume of waste in the asbestos industry is enormous, for much of the rock broken must be discarded. In the Canadian field, the largest in the world, the average yield per ton of rock mined is 1% of "crude" asbestos and a fraction over 6% of mill fiber.

The waste product of milling is known as asbestos, or asbestos sand. It consists of serpentine, unaltered peridotite and a small quantity of very short fiber and is used principally as an ingredient in plaster and stucco. Practically all the rock that goes through the mill is eventually asbestic. In other words, the production of asbestic is approximately the amount of rock milled minus the extraction of mill fiber. A market is found for only a very small percentage of this material.

Copies of the bulletin are available from the U. S. Printing Office, Washington, D. C.

Lime Production in Canada Reaches High Level in 1928

LIME production in Canada during 1928 reached a new high level amounting to 508,889 tons valued at $4,534,568 or 14.4% greater in quantity and 15.6 per cent greater in value than the 1927 production of 444,753 tons worth $3,923,388, according to finally revised statistics issued by the mining, metallurgical and chemical branch of the Dominion Bureau of Statistics at Ottawa. Canadian producers received an average of $12.28 per ton for hydrated lime and $8.28 per ton for quicklime.

Lime producers reported shipments of 46,573 tons of quicklime and 43,620 tons of hydrated lime to the building trades; 153,334 tons of quicklime and 1,187 tons of hydrated lime to chemical works; and 100,788 tons of quicklime and 4,375 tons of hydrated lime to pulp and paper works.

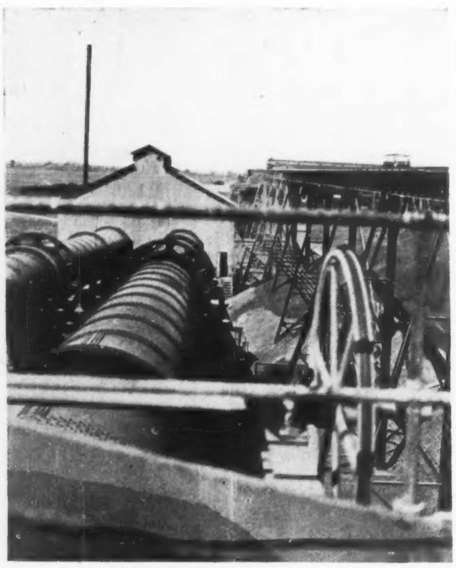
Imports of lime into Canada during 1928 were recorded at 5,417 tons appraised at $64,811. Exports of Canadian lime amounted to 20,043 tons valued at $357,085.

Capital employed in the 54 plants operating in the lime industry in 1928 was reported at $6,952,079. Employment was furnished 100 salaried employes and 1,118 wage-earners; their total earnings were $1,316,115. Fuel used in 1928 cost $856,890, of which amount $418,790 was expended for coal, $324,943 for wood, $73,143 for coke, and minor sums for gasoline, kerosene, fuel oil and gas. Electric power purchased for use in this industry cost $55,505.

Hints and Helps for Superintendents

Slurry Feed Regulator

AT THE plant of the Yosemite Portland Cement Co., near Merced, Calif., the slurry feeder of the conventional ferris-wheel type operates from the kiln drive it-



Home-made slurry feeder regulator

self by a long single strand rope drive so that any changes in speed of rotation of the kiln effect a corresponding change in the rate of feed of the slurry feeders. The illustration shows the rope drive from the kiln to the slurry feeder drive wheel mounted as shown at right. This simple arrangement has proven quite satisfactory and accomplishes the same purpose as the usual synchronized electrical installations.

Loading Starch Dynamites

RECENTLY the Naginey quarry of the Bethlehem Mines Corp. fired a shot which involved the loading of 169 well drill holes with cartridges of starch dynamite, using a total of approximately 50,000 lbs. of powder. Most of the holes were such that the cartridges could be dropped without slitting to the bottom of the holes, but in some sections of the quarry, where the formations were more or less shattered, it was necessary to break the cartridges, the loose free-running starch powder being loaded in these holes by means of a large copper funnel, as shown in the illustration. By use of a copper funnel, danger from sparks and premature explosions thereby resulting are overcome.

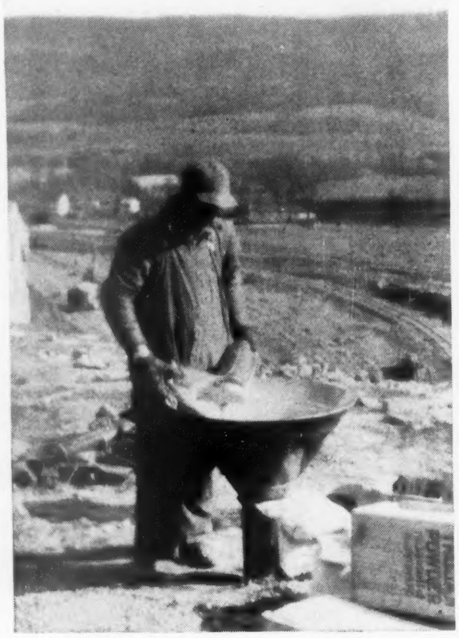
Another Crushing Record?

THE PACIFIC COAST CEMENT CO., of Seattle, Wash., operates a limestone quarry on Dall Island, Alaska. At this quarry we have one 42x48-in. Traylor jaw crusher and one Dixie hammer mill. We have crushed 1141.3 tons of lime rock in eight hours and have crushed over half this amount, or 655.4 tons, in four hours. Our normal daily operation is 125 tons per hour.—D. C. McDonald.

An Inexpensive Babbitting Jig

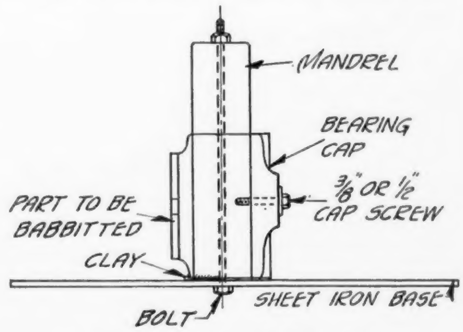
By CHARLES LABBE

AT TIMES when there are a number of bearings to be rebabbited it is well worth while to make an inexpensive jig which will simplify the work and in the same time make it quickly and accurately. The jig shown in the sketch is made of a sheet iron base about 1 foot square and 1/8



Copper funnel used in loading loose powder eliminates spark dangers

to 1/4 in. thick; at the center is a piece of shafting of the required size, the bottom trued up and fastened by either a cap screw through the base or by a bolt clear through. On the side of the shaft or mandrel is a hole tapped for 3/8 or 1/2-in. thread located so that an already babbitted cap can be fas-



Inexpensive babbitting jig

tened through the oil hole tightly against the mandrel.

Having the bearing cap in place and tight, put the half bearing to be babbitted upright, insert full sized shims between the bearings. Use a strong "C" clamp or fasten with the regular bolts, daub the bottom with clay or putty, then pour the hot babbit. On the side of the mandrel there can be as many tapped holes as wanted to accommodate any bearing length.

The same bearing half can be used for all other bearings of the same length or shorter.

The bearing to be babbitted must be warm and have anchor holes. The pouring of babbit endwise (whenever possible) makes a much better job and with less chances of failure.

"Ten Commandments" for Collections

THESE "Ten Commandments" on collections are well worth practical following. Save this as a daily reminder. They are laid down by Lawrence C. Lockley, an authority on the subject:

1. Merchandise your collections. Don't just send a series of duns; build your collection series from the point of view of your debtor; sell him the idea of paying.

2. Don't allow accounts to grow old. Most dead and slow accounts were "good" when they were opened. Start your collec-

Base of crusher, showing the thickness of alloy application

Ready for facing

tion effort at 10 days rather than at 60 days.

3. Be persistent. Even the slowest debtor feels the pull of an infallibly regular collection system. Even the good account tends to slacken with intermittent collecting.

4. Don't be ashamed to ask for money justly due. A firm collection policy not only brings in the money but it gets the most orders.

5. Don't whine. Money is seldom paid because a delinquent customer feels sorry for his creditor.

6. Avoid stunts. The acrobat may "go over big"—but when he falls he sprains his back severely.

7. Stand by your statements. You weaken subsqeuent collection efforts by fruitless threats. The threat is rarely advisable. When made it should be carried out.

8. Cooperate as far as possible with your debtors. The more constructive advice and service you give, the more you will develop and extend your business.

9. Make your collection build good will. Keep ever in mind that an average of 80% or more of the business on your books comes from old customers already on your books.

10. Know your customers. The more you know about a customer the easier it is to collect from him.—*Building Supply News.*

Building Up the Worn Surface of a Gyratory Crusher

An interesting application of the manganese-chrome-iron welding rod, "Hascrome," is described in a recent issue of *Oxy-Acetylene Tips.* This new alloy is of the self-hardening type and is claimed particularly useful for building up worn parts preparatory to resurfacing with Haynes Stellite or other alloy metal surfacing compounds.

The illustration shows the worn cone of the gyratory crusher before repair; this was so badly abraded that it would no longer crush rock to the desired size. At the welding shop it was decided to build up the cone to its original size with Hascrome as a base and Haynes Stellite facing. The surface of the base metal was thoroughly cleaned with Ferro flux, then the Hascrome applied with a flame containing an excess of acetylene, half-way between neutral and the carbonizing flame for Stellite produced the most satisfactory deposit.

Another of the illustrations shows the crusher cone when the welder had completed about half the Hascrome application. The bottom section of the cone is shown in another cut, also when half the deposit had been completed. Thickness of Hascrome at the bottom edge was well over an inch, thinning out further up the cone. This restored the crusher to its original shape and then Haynes Stellite was applied to the surface parts to be subjected to most severe abrasion during operation.

Right — Badly worn crusher in operating position. Lower right — Two manganese steel castings which compose the cone. Below — Being built up with the base alloy

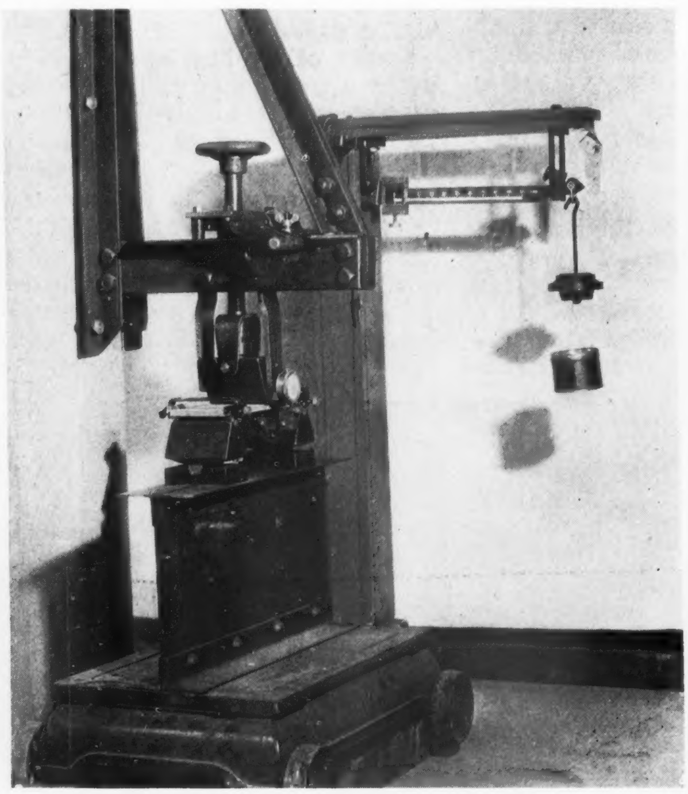
Physical Testing of Slate

By C. W. Macdougall
Assistant Professor of Mining Engineering, Lafayette College, Easton, Penn.

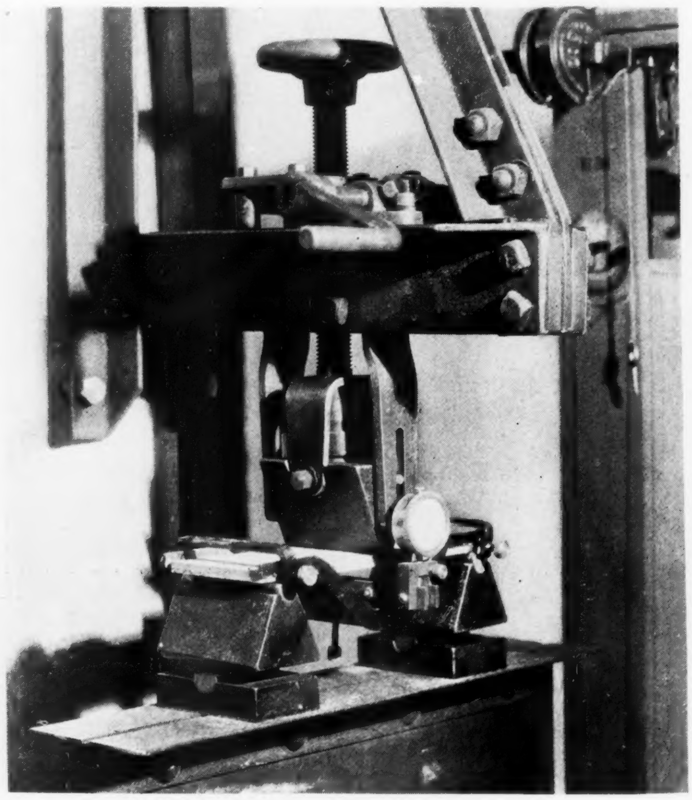
ACCORDING to H. D. Rogers in the Pennsylvania State Geological Survey, Vol. I, pp. 248-249, published 1858, there were two quarries producing roofing slate near the Delaware river, one on the east side of the river, probably the Old Jersey quarry, and one near Slateford on the Pennsylvania side. Professor Behre in his report on "Slate in Northampton County," Bulletin M. 9, State Geological Survey, 1921, states that these quarries were opened possibly about 1812. It is also stated that H. D. Rogers, between 1833 and 1841, in a report previously mentioned, found five quarries near Slatington in operation.

Since that early beginning, the slate industry in Northampton County and Pennsylvania has grown until, according to the reports of the U. S. Bureau of Mines in 1926 Pennsylvania produced 44% of the total slate of the United States with a total value of $5,413,177. Of this amount the Northampton County production was valued at $4,438,648.00, or a little over 82% of the slate production of the state. The above will give some idea of the importance of the slate industry to Northampton county. The total value of slate produced in the United States in 1926 as stated by the above authority, was $12,352,767.00.

Slate has now become an important building material as it is being used to a large extent for floors and trim of rooms in fireproof buildings, sanitary fixtures, wash tubs, burial vaults and for many other purposes besides that of roofing material. As the demand for this material increases, it is important to know just what its physical properties are and to standardize specifications so that the builders and specifiers of the material as well as the owners, can be assured that the material will come up to their expectations.



Slate testing machine built at Lafayette College



Machine with slabs undergoing a flexure test

Committee D-16, A. S. T. M.

The American Society for Testing Materials appointed Committee D-16 on Slate for the purpose of standardizing the specifications and methods of testing. The description following tells of some of the methods used in trying out tentative methods of testing with a view of determining their weak points.

In the early part of 1927 the mining engineering department started a series of tests on slate from various slate districts of the eastern United States in cooperation with Committee D-16 on Slate of the A. S. T. M., in their efforts to establish standard specifications for slate testing. Committee D-16 had established tentative methods of testing slate for water absorption and flexure. After the tentative methods had been published it was found desirable to change the size and shape of the test specimens. Hence, all of the testing at this time was made on specimens conforming to the new tentative specifications. These tests were checked by identical tests made at Rensselaer Polytechnic Institute, Lehigh University, Lafayette College, and the U. S. Bureau of Standards.

Tests Made at Lafayette

The accompanying data show only the results of the tests made by the Mining Engineering Department of Lafayette College. A summary of all tests made may be found in the Report of Committee D-16 on Slate, dated June 24, 1927. Quoting from the report of Committee D-16 on Slate, "Each producer called upon for specimens was asked to prepare four sets from the same block. This plan did not mature in all cases since some of the specimens from certain

districts came from different quarries. For this reason the comparisons (as published in the report) are not as satisfactory as could be desired. However, it appears that the slates from those districts which submitted material from two or more different quarries are very uniform from one quarry to another and hence the results of tests may be assumed to be of value for the purpose in view."

For the purpose of making these tests each laboratory was furnished with five sets of specimens from different quarries, each set containing six specimens for absorption tests and twelve specimens for flexure tests. The specimens for the absorption tests were 6x6x¼-in, hone finished on all surfaces and edges. The specimens used in the flexure tests were 4x12x⅜-in, with planed and rubbed surfaces, half of the specimens being cut with the long axis parallel to the grain and half with the long axis perpendicular to the grain of the slate. Slate coming from quarries where there were no means of smoothing the faces were split along the cleavage planes to a thickness approximating the specifications and cut to size by either shearing or sawing.

Testing Machine

As there was no testing machine available at Lafayette College suitable for these tests, it was necessary to construct one for this purpose. This machine was designed largely after the machine used for similar tests by the U. S. Bureau of Standards with some modifications to adapt it to our particular requirements and was built by the college mechanician.

Absorption Tests

The specimens 6x6x¼-in were dried in a Thelco electric oven, having a temperature varying from 113 to 115 deg. C. (the permissible range of temperature being 110 to 120 deg. C.), for a period of 24 hours and then cooled for 15 minutes in the open room before weighing. The weight of each piece was determined on a fine balance to the nearest 0.01 gm., then immersed for 48 hours in water having a temperature of approximately 20 deg. C. At the end of this period the specimens were removed from the water, all faces and edges thoroughly wiped off with a dry cloth and immediately weighed. The percentage of absorption was calculated from the formula:

$$\text{Percentage of absorption} = \frac{(B-A)\,100}{A} \quad \text{where}$$

A=dry weight of specimen and B=weight of specimen after immersion.

The average of the determinations was taken as the average percentage of absorption unless any one specimen showed a variation of more than 25% of the average value. In this case the specimen was examined for defects and if the result appeared to be due to these defects it was discarded. The data on Tables 1 and 2 shows that, where the specimens are carefully prepared according to the specifications, the percentage of absorption of the slate from any one quarry is extremely low and under the test does not vary greatly. The specimens not prepared according to the specifications have a tendency to vary in the final percentage of absorption. In fact, in two cases the results had to be discarded owing to defects produced largely in the methods of preparing the specimens. The specimens from Virginia were evidently split to the approximate thickness required and then sawed to size by a rough circular saw. This had a tendency to open up spaces along the cleavage planes which might retain an excess of water during testing. The specimens from New York state were simply roofing slate split and sheared to size, the shears making irregular edges, and causing similar conditions to those mentioned for the Virginia slates.

From the data obtained in these tests it has been suggested that when it is not practical to prepare the specimens with honed faces and edges there should be more specimens (nine instead of six) prepared and that these specimens be prepared by splitting along the cleavage planes and then sawing to approximate size by means of a hack saw. This proposed change is excellent, though extreme care must be taken in wiping the specimens dry as there is still some danger of an excess of moisture remaining on the rough surface of the specimen.

Flexure Tests

In all cases the specimens were 12x4x⅜ in. in size, with faces and edges planed to smooth surfaces and finally rubbed to the approximate thickness, with edges honed. Six of the specimens were cut with the

ORIGIN—BANGOR, PENN.

(Axis to grain, parallel)

Maximum deflection	Maximum load	Modulus of rupture	Modulus of elasticity	Absorption — Weight in gm., immersion		
				Before	After	Pct.
48	455	12,900	12,570,000	409.55	410.37	.2000
44	475	12,200	12,350,000	421.99	422.64	.152
50	600	14,950	12,900,000	434.64	435.44	.185
54	640	15,950	12,950,000	423.86	424.81	.225
55	655	17,400*	14,300,000	503.36	504.21	.170
51	530	14,300	12,900,000	465.24	465.95	.153
(Axis to grain, perpendicular)						
35	500	9,770	12,400,000	....	....	......
24	235	6,620*	12,600,000	....	....	......
30	305	8,050	11,800,000	....	....	......
29	345	8,580	12,520,000	....	....	......
36	380	9,820	12,160,000	....	....	......
32	340	8,900	12,810,000	....	....	......

REMARKS: Specimens from soft slate belt. Samples honed on faces and edges. Some ribbons. Color grey. Specific gravity, 2.83.

ORIGIN—PEN ARGYL, PENN.

(Axis to grain, parallel)

Maximum deflection	Maximum load	Modulus of rupture	Modulus of elasticity	Absorption — Weight in gm., immersion		
				Before	After	Pct.
33	490	10,900	15,600,000	608.97	609.93	.157
35	495	14,100	18,320,000*	612.21	613.12	.148
33	505	11,920	15,460,000	620.24	621.13	.144
35	535	13,680	19,280,000*	605.96	606.90	.156
33	460	11,380	15,130,000	608.77	609.72	.157
30	400	10,220	13,780,000*	594.56	595.50	.158
(Axis to grain, perpendicular)						
37	480	11,500	12,630,000*	....	....	......
43	510	13,150	13,250,000*	....	....	......
39	445	11,020	14,100,000	....	....	......
39	475	11,900	14,120,000	....	....	......
40	505	12,910	14,360,000	....	....	......
39	420	11,580	14,290,000	....	....	......

REMARKS: Specimens from soft slate belt. Samples honed on faces and edges. No ribbons. Color grey. Specific gravity, 2.84.

ORIGIN—WALNUTPORT, PENN.

(Axis to grain, parallel)

Maximum deflection	Maximum load	Modulus of rupture	Modulus of elasticity	Absorption — Weight in gm., immersion		
				Before	After	Pct.
46	625	13,580	12,800,000*	445.68	447.15	.329
47	650	15,720	14,250,000	456.31	457.77	.320
33	430	10,880*	15,940,000	436.10	437.53	.327
41	685	14,000	14,920,000	442.81	444.36	.350
44	655	15,230	14,480,000	458.52	460.03	.331
41	625	14,050	15,230,000	456.71	458.25	.336
(Axis to grain, perpendicular)						
37	270	7,610*	11,210,000	....	....	......
37	335	9,080	13,020,000	....	....	......
32	310	8,920	13,520,000	....	....	......
38	335	9,140	13,120,000	....	....	......
34	350	9,940	13,480,000	....	....	......
31	380	10,100	16,300,000*	....	....	......

REMARKS: Specimens from soft slate belt. Samples honed on faces and edges. No ribbons. Color grey. Specific gravity, 2.82.

*Results not used in averages.

ORIGIN—ESMONT, VA.

(Axis to grain, parallel)

Maximum deflection	Maximum load	Modulus of rupture	Modulus of elasticity	Absorption — Weight in gm., immersion		
				Before	After	Pct.
27	415	10,520	18,800,000	419.16	419.55	.094
20	325	9,170	19,700,000	433.47	433.91	.101
27	275	8,490	15,720,000	447.10	449.29	.266*
22	350	10,000	18,850,000	422.96	423.34	.089
28	375	9,280	14,700,000	436.50	436.82	.073
30	300	8,440	13,920,000	410.31	410.71	.074
(Axis to grain, perpendicular)						
31	385	8,860	13,360,000	....	....	......
24	425	8,970	14,770,000	....	....	......
17	275	7,300	17,750,000	....	....	......
21	400	8,360	15,300,000	....	....	......
29	280	9,220	15,700,000	....	....	......
27	350	9,940	16,550,000	....	....	......

REMARKS: Specimens from Virginia, hard soapy texture and very micaceous, phyllite. Samples rough sawed and split. Rough faces. All fractures produced under stress had the characteristic appearance of slate tested with axis perpendicular to grain. Specific gravity, 3.2.

*Results not used in averages.

Note—The results from the fifth set of specimens are not recorded here, as the specimens were of roofing slates hard to size and were apparently rather defective.

length parallel to the grain and six with the length perpendicular to the grain. The specimens were all dried for 24 hours in a Thelco electric oven.

The specimens were loaded at the center of a 10-in. span in the testing machine and the deflections were taken by means of a Randall and Stickney indicator gage reading 0.001 in., placed in a special cradle so that the deflections were taken at the center of the span and the center of the specimen.

Loading of the specimen was in 25-lb. in-

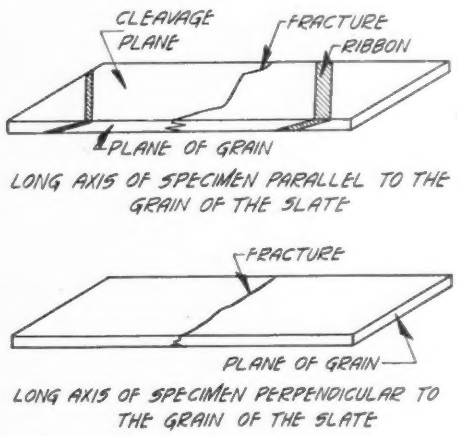


Fig. 1. Characteristic breaks of slate specimens under load

crements at the rate of approximately 100 lb. per minute and the failure point was taken to the nearest 5-lb. load.

From the data obtained in these tests the modulus of rupture was calculated from the formula: $R=\frac{3\,W\,l}{2\,b\,d^2}$ in which R=modulus of rupture, W=breaking load in pounds, l=length of span in inches, b=width of specimen in inches, and d=thickness of specimen in inches.

For the modulus of elasticity, the load deformations were plotted on cross-section paper to a convenient scale and a straight line drawn to represent as nearly as possible the average of the points plotted. A corrected line was then drawn to pass through the origin and the modulus of elasticity was then computed from the co-ordinates of some point on this corrected line from the formula: $E=\frac{Wl^3}{4\,\Lambda\,bd^3}$ in which W=the load ordinate of this point, Λ=deformation ordinate of the point, l=length of span in inches, b=width of specimen in inches, d=thicknes of specimen in inches. Tables 1 and 2 show the condensed results from these tests.

In all cases the width and thickness of specimens was measured to the nearest 0.01 in. Fig. 1 shows characteristic breaks both when the long axis of the specimen is parallel to the grain and when perpendicular to the grain.

Figs. 2 and 3 show load deformation curves of two tests, the curve shown being that of the specimen most nearly approaching the average of the six specimens of the group.

Discussion

As all of the producers did not comply with the request that the specimens be prepared from the same block, the tests showed considerable variation "though the tests may be assumed to be of value for the purpose in view."

It is desired to stress the importance of developing some standard method for the selection of specimens to be tested. The producer should know the physical characteristics of each bed of slate he is working so that he can furnish the buyer with the best slate for any particular purpose. Since there are bound to be variations in the same bed the importance of selecting the specimens is evident. To make this selection, the specimens to be tested should be taken from about the center of the area to be quarried, the date, weather, and location of the sample noted. By location is meant the depth in the quarry, and the position of the block in the bed, whether in the top, middle or bottom of the bed, and the name of the bed. This information should accompany the specimen through the tests and be noted in the final records of the tests. The producer should follow closely the methods recommended by Committee D-16 in preparing the specimens for testing.

These tests should not be used in any way

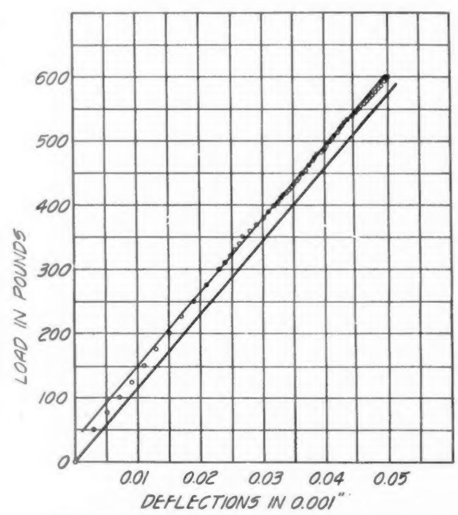


Fig. 2. Load deformation curve—long axis of specimen parallel to the grain of slate

as a comparison between quarries, or different beds. In fact, it would be very hard to compare the value of the slate taken from two quarries on the flexture tests alone, as there are many other considerations to be taken into account. This is always true when comparing natural products.

Possible Yield Point

On plotting the load deformation curves there was found to be a distinct wave in the curve for each specimen tested. This was assumed to be some type of yield point, though the cause for this yield point could not be determined. On taking the matter up with Dr. Kessler of the Bureau of Standards, he stated that this peculiar wave in the stress strain curve was probably due to a defect in the gage. On investigation it was found that the gage did vary considerably between certain points so it was assumed that the wave in the curve came from the gage rather than from some change in the slate.

Testing Roofing Slate

Should it seem desirable to test roofing slate for flexure it might be wise to use some selected commercial size for the test specimen. Then either a test specimen having the required size, 4 by 12 in., could be

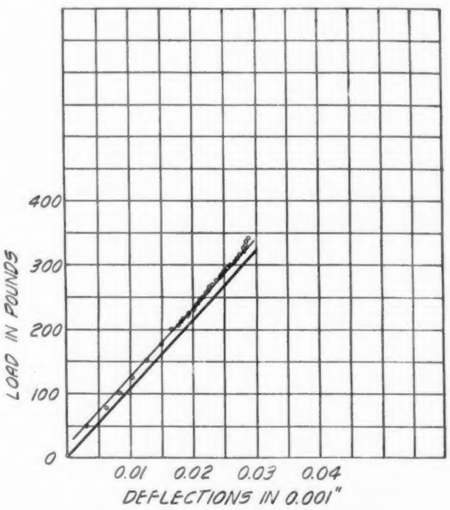


Fig. 3. Load deformation curve—long axis of specimen perpendicular to grain of slate

sawed out with a hack saw in the laboratory or longer bearings could be placed on the knife edges and the specimen tested as received. In the building up of the specifications it would be necessary to specify $\frac{3}{16}$ in. thickness with limits of variations to allow for the difficulties of splitting met with in the manufacture of the roofing slate.

Since there seems to be some confusion in the minds of the users of slate as to the meaning of the word "grain" as used in the specifications of the A. S. T. M., it might be well to offer an explanation of this term.

Recommendations

On examination of the results of these tests as reported by Committee D-16, it is very evident that:

A standard method for selecting the specimens to be tested should be adopted.

No comparison of the slate taken from different quarries based on flexure tests alone should be made.

There should be closer cooperation on the part of the operators in supplying the specimens. That is, if further tests are made, each laboratory should receive specimens from the same block, as recommended by the committee, so that better comparison can be made of that particular slate.

Editorial Comment

Chance for More Research

"It seems regrettable that the many disabilities that afflict concrete should not be removed by thought and study broader than researching and re-researching on strength tests and water-cement ratio alone. Those ploddings and reploddings will never get us anywhere by themselves. And in the meantime concrete must compete with other structural materials as never before in its history."

The above paragraph from a communication by Nathan C. Johnson in the September 19 issue of the *Engineering News-Record*. It contains considerable truth, but like some other assertions of Mr. Johnson it is too sweeping. For example, his assertion that "strength is mere dogma." It is certainly something more than dogma when a highway slab is being considered. And the water-cement ratio is something more than the basis on which concrete is designed for a specified strength.

Economy is also controlled by it. Changing from a fine and poorly graded sand to a coarse, well graded sand may increase the yield and lower the cement factor so that the cement required to make a plastic mortar (leaving the strength out of consideration) will be very much reduced. Changes in the coarse aggregate may have the same, although a lesser effect. And this is wholly because of the effect of these changes on the water-cement ratio. The time required for hardening is also dependent upon it, and by the selection of such aggregates as will permit a low water-cement ratio to be used standard portland cement may be used for highway repairs and in other places where it is essential that the concrete shall harden quickly. And durability and impermeability are two other characteristics that are largely dependent on the water-cement ratio.

Mr. Johnson and all other concrete engineers worthy of the name know these things. But there are thousands of persons who use concrete, including many small contractors, who do not. And it is to reach these that continued insistance on the importance of the water-cement ratio is necessary. Continued research is also necessary, for all the relationships between the water-cement ratio and the properties of the materials used have not yet been discovered.

Having said this much, it may be admitted that more, much more, than a knowledge of the water-cement ratio law is necessary if portland cement and aggregates are to be used intelligently. Fortunately, we are beginning to get some of it. The work of the laboratories of the National Crushed Stone Association and the National Sand and Gravel Association and the research of the U. S. Bureau of Public Roads has given us a great deal and this is being followed up by the work of highway departments and private individuals. We are beginning to make not only better concrete but more economical concrete and we will go farther in that way. This is necessary, for, as Mr. Johnson says, concrete must compete as never before with other materials. And the only way that it can compete successfully is for us to thoroughly understand it, to know its possibilities and limitations and to know the properties and characteristics of the materials of which it is made.

An Aid to Construction

One thing all in touch with the situation agree on is that the recent stock market crash will help construction. High-priced money, a poor bond market, the psychological effect of stock-market gambling on purchasers—jewelry, furs, radios, automobiles and whoopee—the spending on luxuries rather than for homes, all have adversely affected the market for building materials. This drying up of desire and funds for the permanent and comfortable things of life has been felt in the small home-building field for over a year; and in the last six months has begun to be felt in nearly all other lines of building and construction.

How long it will take to right things is, of course, uncertain. But it is true to human nature to go from one excess to another. The probable millions of people who have been more or less losers in the rapid depreciation of stock quotations are bound to do some thinking; and the natural and probable conclusion is that they will realize that there are but two permanently profitable things in life—home and family. Consequently, that home building and improvement will get more of the national income than it has the last year or two is absolutely certain.

It would seem that the small homes field is one that has been somewhat neglected by the rock products industry. Concrete block construction of homes has been fairly well promoted and is firmly established, to be sure, but it is making nothing like the progress that it would make if the public really understood its advantages. It might pay the associations of producers of cement and aggregate to devote more attention to this field than they have, and in doing this they will be doing a public service as well as making a broader market for their products.

And concrete block has no monopoly in this field. Concrete and steel frame and gypsum block and steel frame construction have been developed to where their possibilities are being understood and "gypsum lumber," "concrete lumber" and similar products have passed the experimental stage. Sand-lime brick is thoroughly established and sand-lime products are coming on. The intending home builder need not be confined to one material or any particular style of architecture. He cannot be expected to understand this, however, unless those of us who understand the advantages of our materials tell him about them.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[29]	10-23-29	91	93	
Alpha P. C. new com.	11-19-29	23½	24	75c qu. Oct. 15
Alpha P. C. pfd.	11-18-29	110		1.75 Sept. 14
American Aggregates com.[29]	10-23-29	20	30	75c qu. Mar. 1
Amer. Aggregate 6's, bonds	11-20-29	90		
American Brick Co., sand-lime brick	11-18-29		14	25c qu. Feb. 1
American Brick Co. pfd., sand-lime brick	10-21-29		80	50c qu. Nov. 1
Am. L. & S. 1st 7's[28]	10-23-29	96	98	
American Silica Corp. 6½'s[49]	11-20-29	90	100	
Arundel Corp. new com.	11-19-29	38½	39½	50c qu. Oct. 1
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	11-20-29	No market		
Atlas P. C. com.	11-18-29	30	54	50c qu. Dec. 2
Beaver P. C. 1st 7's[20]	11-15-29	97	100	
Bessemer L. & C. Class A[4]	11-15-29	29	31	75c qu. Nov. 1
Bessemer L. & C. 1st 6½'s[4]	11-15-29	90	92	
Bloomington Limestone 6's[29]	10-23-29	86	87	
Boston S. & G. new com.[47]	11-18-29	17	20	40c qu. July 1
Boston S. G. new 7% pfd.[47]	11-18-29	47	51	87½c qu. July 1
Calaveras Cement 7% pfd.	11-15-29		82½	
Calaveras Cement com.	11-15-29		17	
Canada Cement com.	11-18-29	18	19	
Canada Cement pfd.	11-18-29	91	93	1.62½ qu. Dec. 31
Canada Cement 5½'s[43]	11-15-29	97¼	98	
Canada Cr. St. Corp. 1st 6½'s[43]	11-15-29	95		
Can. Gyp. & Alabastine (new)*	11-18-29	22½	23	37½c qu. Oct. 1
Certainteed Prod. com.	11-19-29	13½	14	
Certainteed Prod. pfd.	11-19-29	50	52	1.75 qu. Jan. 1
Cleveland Quarries new st'k	11-19-29	66	70	75c, 25c ex. Dec. 1
Columbia S. & G. pfd.	11-18-29	80	86	
Consol. Cement 1st 6½'s, A[42]	11-20-29	90		
Consol. Cement 6½% notes[24]	11-20-29	80	85	
Consol. Cement pfd.[29]	10-23-29	50	60	
Consol. Oka S. & G. 6½'s[12] (Canada)	11-15-29	98	101	
Consol. Rock Prod. com.[20]	11-15-29	2½	6	
Consol. Rock Prod. pfd.[20]	11-15-29	15	18	
Consol. S. & G. com. (Can.)	11-18-29	15		
Consol. S. & G. pfd. (Can.)	11-18-29	83	85	1.75 qu. Nov. 15
Construction Mat. com.	11-19-29	18	19	
Construction Mat. pfd.	11-15-29	38¼		87½c qu. Nov. 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[18]	11-14-29	94	98	
Coosa P. C. 1st 6's[29]	10-23-29	50	55	
Coplay Cem. Mfg. 1st 6's[40]	11-15-29	90		
Coplay Cem. Mfg. com.[40]	11-15-29	10		
Coplay Cem. Mfg. pfd.[40]	11-15-29	70		
Dewey P. C. 6's† (1942)	11-20-29	96	100	
Dewey P. C. 6's (1930)	11-20-29	96	100	
Dewey P. C. 6's (1931-41)	11-20-29	96	100	
Dolese & Shepard	11-19-29	93	96	
Edison P. C. com.[39]	11-18-29	10c		
Edison P. C. pfd.[39]	11-18-29	25c		
Giant P. C. com.[2]	11-18-29		25	
Giant P. C. pfd.[2]	11-18-29		35	3½% s.-a. June 15
Ideal Cement, new com.[33]	11-16-29	55	60	75c qu. Oct. 1
Ideal Cement 5's, 1943[33]	11-16-29	92½	96½	
Indiana Limestone units[29] (5 shs. com. & 1 sh. pfd.)	10-23-29	90		
Indiana Limestone 6's	11-19-29	77½		
International Cem. com.	11-19-29	53	55	$1 qu. Sept. 27
International Cem. bonds 5's	11-19-29	89	90	Semi-ann. int.
Iron City S. & G. bonds 6's[46]	11-15-29	80		
Kelley Is. L. & T. new st'k	11-19-29	45		62½ qu., 50c ex., Jan. 1
Ky. Cons. St. com. Voting Trust Certif.[48]	11-14-29	12	13	
Ky. Cons. Stone 6½'s[48]	11-14-29	95	100	
Ky. Cons. Stone pfd.[48]	11-14-29	88	93	
Ky. Cons. Stone com.[48]	11-14-29	12	13	
Lawrence P. C.	11-18-29	50	65	$1 qu. Sept. 28
Lawrence P. C. 5½'s, 1942	11- 6-29	83		
Lehigh P. C.	11-19-29	32	35	62½c qu. Nov. 1
Lehigh P. C. pfd.	11-19-29	101	107	1¾% qu. Jan. 2
Louisville Cement[7]	11-18-29	230		
Lyman-Richey 1st 6's, 1932[18]	11-18-29	96	99	
Lyman-Richey 1st 6's, 1935[18]	11-18-29	95	98	
Marblehead Lime 6's[14]	11-15-29	97	100	
Marbelite pfd.	11-15-29	13¾		
Material Service Corp.	11-19-29	20	22½	50c qu. Dec. 1
Medusa Portland Cem.[29]	10-23-29	120	123	1.50 Oct. 1
Mich. L. & C. com.[6]	11-18-29	35		
Missouri P. C.	11-19-29	34	35	50c qu., 50c ex. Nov. 1
Monolith Midwest[9]	11-14-29	8½	10	
Monolith bonds, 6's[9]	11-14-29	97	98	
Monolith P. C. com.[9]	11-14-29	13½	14	40c s.-a. July 1
Monolith P. C. pfd.[9]	11-14-29	9	9½	40c s.-a. July 1
Monolith P. C. units[9]	11-14-29	31½	33	
National Cem. (Can.) 1st 7's[43]	11-15-29	97½		
National Gypsum A com.	11-19-29	9	11	
National Gypsum pfd.	11-19-29	40	45	
Nazareth Cem. com.[26]	10-19-29	15	25	
Nazareth Cem. pfd.[26]	10-19-29	95	100	
Newaygo P. C. 1st 6½'s[29]	10-23-29	101½		
New Eng. Lime 1st 6's[14]	11-15-29	95	98	
N. Y. Trap Rock 1st 6's	11-19-29	94		
North Amer. Cem. 1st 6½'s	11-19-29	42⅞		
North Amer. Cem. com.	11- 8-29	2¼		
North Amer. Cem. 7% pfd.[29]	10-23-29		29	1.75 qu. Aug. 1
North Amer. Cem. units[29]	10-23-29		33	
North Shore Mat. 1st 5's[15]	11-20-29	90		
Northwestern States P. C.[37]	7-26-29	140		2% Oct. 1
Ohio River Sand com.	11-19-29		30	
Ohio River Sand 7% pfd.	11-19-29	99	102	
Ohio River S. & G. 6's[16]	11-18-29	80	90	
Pac. Coast Agg. 6½'s[23]	11-14-29	99		
Pac. Coast Agg. 7's[23]	11-14-29	99		
Pac. Coast Cem. 6's, A[5]	10-17-29		95	
Pacific P. C. com.	11-15-29	22	25	
Pacific P. C. pfd.	11-15-29	75	79	1.62½ qu. Oct. 5
Pacific P. C. 6's[5]	10-17-29	99¼	100	
Peerless Egyp'n P. C. com.[21]	11-18-29	1	2½	20c Dec. 20
Peerless Egyp'n P. C. pfd.[21]	11-18-29	80	85	1.75 Dec. 31
Penn-Dixie Cem. 1st 6's	11-19-29	60		
Penn-Dixie Cem. pfd.	11-19-29	21	25	1.75 qu. Sept. 15
Penn-Dixie Cem. com.	11-19-29	4¾	5	
Penn. Glass Sand Corp. 6's	11- 6-29	101	103	
Penn. Glass Sand pfd.	10- 9-29	115		1.75 qu. Oct. 1
Petoskey P. C.	11-19-29		10	1½% qu. Sept. 1
Riverside P. C. com.	11-15-29		25	
Riverside P. C. pfd.[20]	11-15-29	82	87	1.50 qu. Nov. 1
Riverside P. C., A[20]	11-15-29	13	15	31¼c qu. Nov. 1
Riverside P. C., B[9]	11-14-29	5		
Santa Cruz P.C. 1st 6's, 1945‡	11-15-29	108½		6% annually
Santa Cruz P. C. com.	11-15-29	95	100	$1 qu. Oct. 1
Schumacher Wallboard com.	11-15-29		9	
Schumacher Wallboard pfd.	11-15-29		24½	50c qu. Nov. 15
Southwestern P. C. units[44]	11-14-29	270		
Standard Paving & Mat. (Can.) com.	11-18-29	22	23	50c qu. Nov. 15
Standard Pav. & Mat. pfd.	11-18-29		90	1.75 qu. Nov. 15
Superior P. C., A	11-15-29	38	40	27½c mo. Dec. 1
Superior P. C., B	11-15-29	12		
Trinity P. C. units[37]	7-26-29	142	150	
Trinity P. C. com.[37]	7-26-29	51		
Trinity P. C. pfd.[29]	10-23-29	110	115	
U. S. Gypsum com.	11-19-29	47¾	50¼	2% qu. Dec. 31
U. S. Gypsum pfd.[29]	11-20-29	105	115	1¾% qu. Dec. 31
Universal G. & L. com.[8]	11-20-29	1		
Universal G. & L. pfd.[8]	11-20-29	8		
Universal G. & L., V.T.C.[8]	11-20-29	25c		
Universal G. & L. 1st 6's[8]	11-20-29	No market		
Warner Co. com.	11-18-29	30	40	50c qu., 50c ex. Oct. 15
Warner Co. 1st 7% pfd.	11-18-29	95	100	1¾% qu. Oct. 1
Warner Co. 1st 6's[8]	11-20-29	98	101	
Whitehall Cem. Mfg. com.[36]	10-31-29	125		
Whitehall Cem. Mfg. pfd.[36]	10-31-29	98		
Wisconsin L. & C. 1st 6's[15]	11-20-29	90		
Wolverine P. C. com.	11-19-29	4	6	15c qu. Nov. 15
Yosemite P. C., A com.[20]	11-15-29	2¼	3¼	

†$484,000 called for redemption at 103½ October 1. *Dividend equivalent to $6 per share per annum on old capital stock recently split up on a 4 for 1 basis and on which quarterly dividends of 75c per share were paid. ‡Entire issue called for redemption at 110, March 1, 1930.

[1]Quotations by Watling Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by Rogers, Tracy Co., Chicago. [4]Quotations by Butler Beadling & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]By J. J. B. Hilliard & Son, Louisville, Ky. [8]Quotations by Dillon, Read & Co., Chicago, Ill. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbit, Thomson & Co., Montreal, Canada. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Peters Trust Co., Omaha, Neb. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co., of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hoit, Rose & Troster, New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simons & Co., Inc., Detroit, Mich. [22]Hemphill, Noyes & Co., New York City, N. Y. [23]California Co., Los Angeles, Calif. [24]A. B. Leach & Co., Inc., Chicago, Ill. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [32]A. E. Ames & Co., Toronto, Can. [33]Boettcher Newton & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [38]McFetrick & Co., Montreal, Que. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [41]Hornblower & Weeks, New York City and Chicago. [42]E. H. Rollins, Chicago, Ill. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney, Williams & Co., Inc., Los Angeles, Calif. [45]Taylor Ewart & Co. [46]Stein Bros. & Boyce, Baltimore, Md. [47]Wise, Hobbs & Arnold, Boston. [48]E. W. Hays & Co., Louisville, Ky. [49]Blythe Witter & Co.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
American Brick Co. pfd., 50 sh.[5] (par $25) per sh.	22½ ex-div.	
American Brick Co. com., 20 sh.[8]	$10 per share	
American Brick Co. pfd., 20 sh.[8] (par $25)	$18 per share	
Atlantic Gypsum Prod. Co. pfd., 750 sh.[10]	$10 per share	
International Portland Cement Co., Ltd., pfd.	30	45
New England Lime Co. Series B, 60 sh.[9]	$15 per share	
Rockland & Rockport Lime Co. 2nd pfd.[7] 13⅓ sh.	2⅞ per share	
Rockland & Rockport Lime Co. com.[7] 14⅔ sh.	55c per share	
Southern Phosphate Co.[6]	1⅛	
Universal Gypsum com. free stk.[1] 300 shares	$75 for the lot	
Vermont Milling Products Co. (slate granules), 22 sh. com. and 12 sh. pfd.[6]	$1 for the lot	
Winchester Rock Brick Co., pfd., 1 share (par $25) and 1 share com. (par $10)[6]	$8 for the lot	

[5]Price at auction by R. L. Day & Co., Boston, October 23, 1929. [6]Price at auction by Wise, Hobbs & Arnold, Boston, Mass., June 19, 1929. [7]Price obtained at auction by R. L. Day & Co., August 21, 1929. [8]Price at auction by Wise, Hobbs & Arnold, Boston, October 16, 1929. [9]Price at auction by R. L. Day & Co., Boston, October 16, 1929. [10]Price at auction by R. L. Day & Co., Boston, November 6, 1929.

U. S. Gypsum Estimated Earnings for 1929

NET earnings of the United States Gypsum Co. for the year ending December 31, 1929, will probably equal between $5 and $6 a share on an average of about 850,000 shares of common stock outstanding during the year. This would compare with $7.22 a share on 760,437 shares outstanding in 1928. The number of shares of stock now outstanding is about 1,130,000.

Earnings for the third quarter of this year averaged equal or possibly a little higher than for the two preceding quarters. During the period, the company obtained higher prices for its products, but this was offset by a slump in building activity.

The outlook for the company is understood to be favorable. More than $15,000,000 has been spent recently on improvements to facilities and in providing new plants and distributing points. New products also have been developed to meet particular requirements of customers.—*Chicago* (Ill.) *Journal of Commerce*.

National Gypsum Co.

THE balance sheet of the National Gypsum Co. as of September 30, 1929, is as given below:

BALANCE SHEET, AS OF SEPTEMBER 30, 1929

Assets:	
*Buildings, equipment, etc.	$2,385,877
Land, gypsum and lime deposits (less depl.)	3,068,072
Current Assets:	
Cash	52,466
Call loans	500,000
Notes, accounts rec. (net) advances	616,023
Inventories	298,271
Other assets	431,258
Total	$7,351,967
Liabilities:	
Preferred stock	$2,629,567
†Common stock and surplus	3,697,732
Bonded debt	621,000
Long term contracts	182,837
Farm mortgages	37,292
Current Liabilities:	
Notes and accounts payable	117,907
Accruals, etc.	65,632
Total	$7,351,967
Current assets	$1,466,760
Current liabilities	183,539
Working capital	$1,283,221

*After depreciation, $373,264. †Represented by 147,452 1/6 no par shares.

Certain-teed Products Corp.

ACCORDING to an estimate of George M. Brown, president, net earnings will be sufficient to justify payment of cumulative dividends on preferred stock during the second half of next year, but no payment should be expected on common regardless of earnings until after a substantial accumulation of earned surplus. Business in the fourth quarter this year will be affected by old commitments at some of the former prices and by the necessity for the trade to work off heavy purchases earlier in the year when prices were extremely low. The mistake made in attempting to hold prices on roofing and gypsum products in 1928, despite price cutting by competitors, resulted in heavy losses in business. Price reductions were met by the company this year with a result that loss in volume was recovered on roofing products. Recovery of business in gypsum products line was somewhat less. With the more recent strengthening of prices and on a volume of sales equal to average for years 1927, 1928 and 1929, it is estimated that the company would earn on a full year's business more than $4 per share on the common stock.

CONSOLIDATED EARNINGS

3 mos. to Sept. 30:	1929	1928
Gross profit af. dep. & depl.	$1,220,949	$1,262,015
Other income	32,472	41,674
Total income	1,253,421	1,303,689
Cost, exp. and bank int.	1,102,254	1,097,306
Bond interest	185,821	189,292
Federal taxes	7,600	4,672
Sundry adjustments (net)	8,045	*1,487
Balance	†$50,299	$13,906
9 mos. to Sept. 30:	1929	1928
Gross. profit af. dep. & depl.	$3,164,150	$3,513,971
Other income	48,518	112,391
Total income	3,212,668	3,626,362
Cost, exp. and bank int.	3,334,798	3,147,816
Bond interest	560,379	410,062
Federal taxes	29,800	18,002
Sundry adjustments (net)	3,468	*3,991
Balance	†$715,777	$54,473

*Credit. †Debit.

Pennsylvania-Dixie Cement Corp. Omits Dividend

DIRECTORS of Pennsylvania-Dixie Cement Corp. voted to omit the quarterly dividend due at this time on the 7% cumulative preferred stock. This action was deemed advisable, it was stated, by reason of the falling off in earnings resulting from the competition of duty-free foreign cement, reduced domestic demand and drastic reductions in selling prices by competing companies.

It is further stated that the cash position of the company is excellent, the balance sheet as of October 31, 1929, showing a ratio of current assets to current liabilities of nearly 10 to 1.

Peerless-Egyptian to Reduce Capital Stock

DIRECTORS of the Peerless-Egyptian Cement Co., at a special meeting recently, decided to change the name of the company to the Peerless Cement Corp. and to reduce the number of common shares outstanding from 1,200,000 to 240,000, or on a basis of one share for five. They declared a dividend of $1 per share on the new stock which is at the rate of 20 cents per share on the present stock now outstanding.

This dividend will be paid on December 20, to stock of record December 5.

Directors also declared the regular quarterly dividend of $1.75 per share on the preferred stock, payable December 31 to stockholders of record as of December 20.

In addition, the directors decided to make application to list the new stock of the Peerless Cement Corp. on the Detroit Stock Exchange.—*Detroit* (Mich.) *Free Press*.

Financial View of Cement Company Earnings

DISCUSSING the financial outlook of the portland cement industry, the *Wall Street News* (New York City) stated recently:

"Cement companies are beginning to feel severely the hardships and unsatisfactory conditions that have been developing this year and there is considerable uncertainty over the maintenance of present dividend rates by at least two of the larger companies. A tapering off of building activity early this year, Belgian importations, overproduction and a series of price reductions have affected profits despite the fact that several companies are reporting increasing sales.

"The Alpha Portland Cement Co., which was recently listed on the New York Stock Exchange, showed earnings of $2.60 a share on the 711,000 shares of common stock for the 12 months ended September 30, a sharp decline from the previous year. Dividend payments are made on the common at the rate of $3 annually and it is doubtful if the company can show earnings sufficient to cover the dividend for the year ending December 31. Because of this probability a reduction in the present dividend rate is expected. The company is in good financial condition with cash and its equivalent on September 30 amounting to nearly $7,000,000. The ratio of current assets to current liabilities at that time was beter than seven to one.

Foreign Competition

"Foreign competition and price reductions along the Atlantic seaboard has been particularly severe on the Pennsylvania-Dixie Cement Corp., as 40% of its producing capacity is in the territory affected by these unsatisfactory conditions. For the 12 months ended September 30 net earnings amounted to $686,000, equal to $5.05 a share on the 135,888 shares of preferred stock with dividend requirements of $7 annually.

"Lehigh Portland Cement Co. and the International Cement Corp. are the two large companies that have been least affected by the depression. Earnings of Lehigh for the nine months ended September 30 amounted to $5.70, against $5.57 in the corresponding 1928 period. This company does 12% of the total for the industry. Its dividend of $2.50 a share annually will be earned by a wide margin and its financial position is secure with over $12,700,000 in cash.

"Earnings of International Cement this year are expected to approximate those of 1928 when $7.90 a common share was reported. Earnings for the first nine months were slightly above those of the similar 1928 period. While price cutting, competition and importations forced the closing of the company's new Norfolk mill late this past summer, other mills are so well distributed geo-

graphically here and in South America that curtailment in one district has less effect on operations on the entire system than might be the case if production was centered in a more restricted territory.

"With prospects of tariff protection considerably dimmed by the changed legislative conditions in Washington, some officials point out that trade conditions could be substantially improved if a serious effort was made by interests representing the various companies to come to some sort of an agreement concerning price cutting. Any agreement reached would probably be subject to approval by official quarters in Washington."

Marbelite Corp. of America

IN LETTER to stockholders, H. C. Stuart, secretary-treasurer, stated net profits for nine months ended September 30 exceed those of a like period last year by $35,242. Omission of regular dividends this year was occasioned by expenses accompanying expansion program followed this year. Expenses incurred by expansion were met without additional financing and surplus of $76,776 remains.

BALANCE SHEET, AS OF SEPTEMBER 30, 1929

Assets:	
Fixed assets	$266,896
Patents, good-will, etc.	49,848
Investments	205,670
Cash	36,612
Notes and accounts, receivable	119,523
Inventories	113,156
Total	$791,705
Liabilities:	
Capital stock	$640,285
Accounts payable	30,672
Accruals	43,972
Surplus	76,776
Total	$791,705

Cleveland Quarries Increases Dividend Rate

AN INCREASE of 25c over the regular quarterly dividend rate of 50c per share, and the declaring of an extra dividend to common stockholders of the Cleveland Quarries Co. has been announced.

The new rate is 75c a share, and the extra to be paid to all security holders of record November 15 is 25c per share, both payable December 1.

(British) Associated Portland Cement Manufacturers

SHAREHOLDERS of Associated Portland Cement Manufacturers will meet shortly to vote on their directors' recommendation to maintain ordinary dividend at 8% as in the preceding year. According to the report of the company sales during 1928 were in excess of those during 1927, but trading profits declined by £56,500, a shortfall which was, however, more than compensated for by an advance of £88,900 in receipts from interest and dividends. As a result, the company's net profit rose by £32,900 to £366,400, after making the usual generous provision for depreciation reserves. The proposed 8% ordinary dividend payment involves the disbursement of £40,000 extra, because £500,000 more capital ranks for return. Investment holdings, including loans, are £502,800 higher. A decline of £64,000 in creditors is set off by decreases of £21,700 in debtors and £23,600 in inventories, while the cash holding has been reduced by £169,500 to £347,400.

The cement industry, in the whole, is in a healthy condition and registered maintenance and even increase of demand during 1928. Due to increased competition in Great Britain as well as abroad the range of prices was lower last year and the results of the current year must depend largely upon the maintenance of the existing level of values. In this connection it is generally held that the plants and processes now in use are capable of coping with any increased consumption which is likely to occur in the near future. Fortunately, leading British cement manufacturers have recently sought to eliminate unnecessary competition through the fixation of prices and delimitation of territories to be served. These arrangements should exert an important stabilizing influence upon the industry during the current year. In the past year, when competition in the industry had a free career, the effect of price reductions upon revenue was met by economies arising from the improvement of manufacturing processes and from increased demand. If as is expected, the increase in demand for cement should advance in 1929 at the rate it did in 1928, the present year promises to be a record breaker for the best companies in this field, including Associated Portland Cement Manufacturers and the British Cement Co.—*Wall Street News* (New York City).

Four German Cement Firms to Consolidate

FOUR German companies controlling 50% of the country's portland cement production, have agreed to combine, according to the Berlin correspondent of the London *Financial Times*. The merger is independent of the Cement Syndicate. All the companies are rationalized, prosperous and have very modern plants.

"The directors of the new combine," says that newspaper, "announce that their contract is absolutely independent of the German Cement Syndicate.

"It seems very probable that the intention of the firms concerned is to have a solid organization ready in case the syndicate is dissolved, as is confidently expected. The firms which have signed the new agreement are: Dyckerhoff and Sons' Portland Cement Factory at Mayence; E. Schwenk Cement and Stone Works at Ulm, on the Danube; the Heidelberg and Mannheim Portland Cement Works in Heidelberg, and the Silesian Portland Cement Industry Co. in Oppeln. The firms named control 50% of the total German production of portland cement.

"The Silesian Portland Cement Co. has a capital of 27,000,000 marks and has paid a dividend of 12% for each of the past two years. The Heidelberg Portland Cement Works has a capital of 30,000,000 marks and has paid 10% for 1927 and 1928. The other two companies are similarly prosperous.

"The German Cement Syndicate is practically in process of dissolution, as its chief members, the Wicking group, is tired of contributing to the cost of fighting outsiders and considers that, with its thoroughly rationalized works, it can crush outsiders better than if it were bound up with the syndicate. The Wicking group is not on too good terms with the new amalgamation.

"It is known that the companies comprised in the new combine are as efficiently rationized as the works of the Wicking concern, and that their plant is very modern. It is announced that a foreign financial group, believed to be American, has arranged to establish portland cement works in Germany and also in some unnamed adjoining country, which will be equipped as a most modern plant."

Santa Cruz Portland Bonds Called

SANTA CRUZ PORTLAND CEMENT CO.'S first mortgage 6s, 1945, in amount of $340,000, have been called for redemption at 110 on March 1, 1930, at the company's office in San Francisco.

Petoskey Portland Notes Maturing

THE 6% notes of the Petoskey Portland Cement Co., Petoskey, Mich., in amount of $200,000, are due December 1, 1929.

Recent Dividends Announced

Atlas P. C. com. (qu.)	50c, Dec. 2
Canada Cement pfd. (qu.)	$1.62½, Dec. 31
Cleveland Quarries (qu.)	75c, Dec. 1
Cleveland Quarries (extra)	25c, Dec. 1
Consumers Co. pr. pfd. (qu.)	1½%, Jan. 1
Ind. Limestone pfd. (qu.)	1¾%, Dec. 2
Kelley Island L. & T. (qu.)	62½c, Jan. 1
Kelley Island L. & T., extra	50c, Jan. 1
Lehigh P. C. pfd. (qu.)	1¾%, Jan. 2
Peerless-Egyptian Cem. com. (qu.)	20c, Dec. 20
Peerless-Egyptian Cem. pfd. (qu.)	$1.75, Dec. 31
Schumacher Wallboard pfd. (qu.)	50c, Nov. 15
Superior P. C. Cl. A (mo.)	27½c, Dec. 1
Standard Paving and Materials pfd. (Can.) (qu.)	$1.75, Nov. 15
U. S. Gypsum com. (qu.)	40c, Dec. 31
U. S. Gypsum pfd. (qu.)	1¾%, Dec. 31

Developing New Sand and Gravel Deposits

Reviewed by Edmund Shaw
Contributing Editor, Rock Products

NOT ONLY the producers of sand and gravel, but all those who are interested in the orderly development of our natural resources, will appreciate "Economics of New Sand and Gravel Development." This is Economic Paper No. 7, of the Bureau of Mines, Department of Commerce, and its author is J. R. Thoenen, who is well known to Rock Products readers for his many contributions and his studies of underground quarry problems. This report ought to be studied by everyone who contemplates opening a new sand and gravel deposit, including those operators who have already had considerable experience in such matters. For it gives in a condensed and easily understood form those things which should be learned, not only about the deposit but about the market and the prospects of future competition, before money is invested.

Good for Ordinary Scale Producer

The report is written for the ordinary scale producer who has obtained control of a deposit, and its purpose is to "present, in a condensed form, those factors that require study in starting such a new venture and thus to assist the new operator in establishing his business on a sound basis." To begin with, a bird's-eye view of the whole industry is given by means of charts which show the production, price and total value in each state and in the United States as a whole. The paper concludes from a study of these that production over the whole country has not reached saturation, although "curves from the different states tell a different story and indicate that the local situation is rapidly approaching a condition of saturation, if not overproduction." It is suggested that the producer study these along with local data.

The curve for the United States shows a varying production from 1910 to 1921, and then a remarkable upward sweep to 1927, when the production went from 80,000,000 tons to almost 200,000,000 tons. This is almost paralleled by the curves of some of the states with the greater productions—New York, Illinois, Michigan and California—except that California curves break badly at the 1924 line. But many of the states of smaller production show curves which have pronounced peaks and valleys, and it would pay producers well to study the reasons for these. For example, several of these states show a strong peak at about the 1924 line, which may be accounted for by the great amount of highway building done at that time in these states. This suggests that the intending producer would do well to plot these curves along with the curves of building permits, general construction and highway construction, to see how these influence the market.

Prices

The value-per-ton line for the United States shows a level price of 35 cents from 1907 to 1914. Then there was a steady rise to 80 cents, the peak coming in 1920. This was just before the big rise in production, it will be noted. After 1920 the price gradually fell to 50 cents, in 1927, the last year recorded on the charts. This is the average for all materials from the cheapest to the highest priced.

Most of the curves for the states show this peak value in 1921, although some of them show it a little later. The decline in most states has been fairly steady since that time. The states which have curves showing a fairly level price or a rising curve in 1927 are: Alabama, Arkansas, Georgia, Indiana, Kansas, Kentucky, Minnesota, Nebraska, Nevada, New York, New Jersey, Oklahoma, Utah, Virginia and Maryland. In the others the curve has a downward tendency, although in some instances this is small. The addition of the figures for 1928 and 1929 would probably show more states with declining prices as there has been a decline of production in several states since 1927.

Geology Not Discussed

Not much is said about the geology of deposits, but a great deal is said about the necessity of knowing the geological features of any particular deposit and how to get information from the maps and reports of state geologists. To aid in this a most valuable feature of the paper, a list of state geologists is given with their addresses. But, as the author rightly says, the producer is not so much interested in the origin of sand and gravel as how to find it, and the paper takes up the search beginning with the examination of large areas, such as are found along the banks of streams and lakes and ocean beaches, especially those left by water that long ago has vanished. In this, as is said, the study of geological data is invaluable, and it is suggested that detailed study makes it possible to chart the courses of ancient rivers and predict the occurrence of gravel deposits.

The reviewer has long felt that more of this work should be done, and that it would be possible in this way to locate deposits in certain parts of the country where coarse aggregate is none too plentiful and where gravel is becoming especially scarce.

Types of deposits, unfortunately, are not considered, presumably because it would lead to more discussion than such a paper could contain. But it is unfortunate that no one has written on this subject, and it is suggested that it would be an excellent field for a man so well equipped as Mr. Thoenen, who is a geologist and an engineer, to work in. There is a vast difference in the hilltop deposits of the Atlantic Coastal plain and the old river terrace deposits found farther inland, and both these differ widely from the glacio-fluvial deposits of the Northeast, and the deep washes of the Pacific Coast. And the differences affect the whole operation, excavating and transporting the raw material, plant operation and design, and the shipping of the product. It would lead to a better understanding of the problems of the industry if this work could be done.

Prospecting

The sections on prospecting are ample and complete, the only omission noted being that of the gravel pump which does such satisfactory work in the deposits along the Colorado river in Texas. The bucket in a pipe method is described in detail, including the method of estimating the clay present. It is pointed out that geophysical methods, so important nowadays in prospecting ore bodies, have no place in alluvial prospecting. Reference is made to books on placer mining, in which well-known and thoroughly tested methods of prospecting alluvial deposits are given. Both test-pitting and drilling are discussed.

The great importance of correct sampling as well as prospecting is well brought out. In the opening paragraph of this section the paper says: "It is important, therefore, that a very careful and thorough investigation be made before money is invested in equipment for exploitation. *There are comparatively few deposits favorably located that have material of the desired character and quality, considering the proportion of fine to coarse particles and the freedom from clay.* Commercially practical sand deposits may be said to be scarce. The uninitiated should be especially sure of his ground before embarking in the business." The italics are the reviewer's, and he would like to see this warning placed before everyone who contemplates breaking into the business. A similar caution is given in several other places in this paper.

Development

A good example of this is given in the section on development, where Mr. Thoenen says:

"To the uninitiated investor the presence

of sand and gravel is generally the criterion, and only very superficial evidence is necessary to satisfy him. He considers the comprehensive report of a competent engineer as an extravagance and cannot understand why the engineer requires so much time and money to ascertain the information on which to base his conclusions, when the promoter can furnish him with such pleasing and satisfactory data with but little expenditure of time and money. In many instances a short preliminary examination by a competent engineer would have disclosed the facts."

As this paper is addressed to the intending investor, the man who would add to what is in most localities an already sufficient production of sand and gravel, it is quite proper that it should be careful to point out all the difficulties that may be met. For example, in the section on overburden, the difficulties due to its removal are:

Overburden

"If none of the overburden is of a marketable character, its disposal becomes a major problem. In many cases the waste overburden has been piled upon ground that has been found later to be needed for building sites, and in consequence the pile of waste must be handled a second time. Evidences of this lack of foresight can be seen in every section of the country, not only in sand and gravel plants but in quarries and mines as well. In other instances the overburden from certain portions of a deposit has been stripped and piled on other portions and must be removed a second time before the sand and gravel below can be obtained, thus causing a doubly expensive stripping operation. Deposits located near cities or within city limits are often bounded by valuable building sites, and when the area available for excavation is small it may be difficult to find suitable disposal space. In such cases the expense incurred in removing the overburden and disposing of it may be prohibitory and may render the deposits of no commercial value, even though its quality is admirably suited to the local markets. Deposits located within city limits, however, may have an advantage over others in that stripped material can often be disposed of for filling purposes at prices that will return the cost of excavation and transportation and sometimes even a profit.

"In rural communities or farming sections some states require gravel producers to leave the surface of the land in as good condition for agricultural purposes as it was prior to their operations."

Even an experienced operator might find himself ignorant of some of the above conditions if he were to move to another locality with which he was not familiar.

The sections which describe how the market should be studied and the operations after the deposit has been developed may be passed over without much comment, as there is nothing to criticize in them although there is much to praise. The section on marketing possibilities is especially good as it includes the prospects of future competition as well as the actual market now in sight. But a word or two should be said about the sections on capital requirements and operating costs.

Capital Requirements

In the first part of the section on capital requirements there is an excellent discussion of the factors which affect it, especially those liable to increase it, such as a short working season, the need to buy ground, not only to provide for the future while the land is cheap, but to keep out competition, and local reasons for long and expensive trackage, the necessity of large storages and so on. But in the latter part there is a table compiled from a directory, which is open to criticism. Of course, the paper does not vouch for the accuracy of the figures, which the bureau did not collect and could not check. They are "offered as indicative of minimum capital requirements." In the reviewer's opinion they are misleading.

The average minimum requirement figured is $1 per ton of annual capacity. This is probably correct enough if it is fully understood that this is *only* an average and a minimum. The actual investment for the whole industry is probably much more. It is usually stated that $400,000,000 is invested in the sand and gravel industry of the country. If this is true, and the annual production is (roughly) 200,000,000 tons, the investment would be $2 per ton. Some investigations by local associations, of which the reviewer knows, tend to confirm this figure, although some of the large producing companies have a much less investment, less than $1 per ton, in fact. Granting that this $2 per ton was not all wisely spent, there is no guarantee that all the money invested in a new operation will be wisely spent. It would be safer for the investor to figure on $2 a ton rather than $1, where he is not fully acquainted with the business and with all the factors which could increase or decrease the amount of money required.

Some of the capitalizations given in the table are so low as to seem impossible. A conspicuous example is that of a dragline operation, reported as needing only $0.04 per ton for 800,000 to 900,000 tons per annum. Taking averages, this would mean an investment of only $34,000 for producing 850,000 tons per year. It is hard to see how even the simplest operation, loading dune sand or ballast directly into cars, using a second-hand dragline and working all the year, could do with so little money. Another example, not quite so extraordinary, is that of two companies, also using draglines, which, it is claimed, produce from 1,000,000 to 2,000,000 tons per annum with a capitalization of only $0.11 per ton. On the other hand, the capitalizations for operations of medium tonnages appear to be fairly reasonable, if theoretical capacity, and not actual production, be used as a divisor.

Any table of capital requirements to mean much must be made of comparable figures, and the only way to get these would be to classify the operations by both the raw material and the finished product. One cannot compare the cost of a simple sand pump with that of a plant working heavy ground that requires a considerable investment in crushers and accessories.

Operating Costs

Operating costs are very well discussed and it is shown that these are absolutely dependent on local conditions, so that only an engineer, familiar with these conditions as well as the industry in general could figure them in advance. One paragraph discussing the necessity of full information regarding costs is so good that it is quoted in full:

"Production costs may be subdivided into two general divisions—operating costs and overhead costs. In too many cases the inexperienced operator has considered his operating cost to be his total cost, and there are innumerable instances in which people have entered the sand and gravel business with a false idea of costs and as a result have failed. Such failures not only result in loss to themselves but also to the business in general. Newcomers in the industry, basing their estimates merely on operating costs to gain business, cut prices below those already established by more experienced operators. As a result the older operators to compete have to cut their prices below actual costs as computed on the basis of operating costs plus overhead costs. Under these circumstances all producers lose money and a false idea is created among consumers as to what constitutes a fair price."

As a whole the paper is excellent, much the best and, in fact, the only full presentation of the subject that has come to the reviewer's notice. If it has a fault it is that it is too brief. The material that has been collected and the way it is presented are both so interesting that one would like to see the paper expanded to a considerably greater length. It is worth careful study by every producer, whether he intends to open new ground or not. In addition to the test reviewed there is an excellent bibliography of the whole subject of sand and gravel production, beginning with prospecting the ground and going through to the specifications for the finished product.

It is refreshing to read a paper of this kind as too often state and governmental publications concerning new industries have neglected to warn the intending investor and the public, merely laying down the course that should be followed to get a property to the producing stage. Probably there are still some localities in the United States where a new operation might find a real market for its product, but they are few.

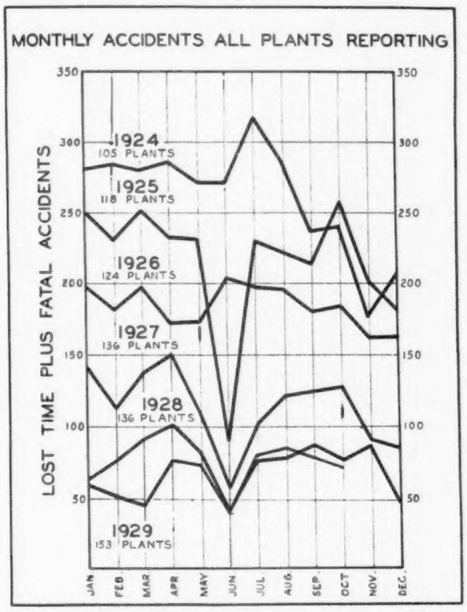
Cement Mills Watching Safety Records

AS the year draws near to the close, accident prevention work in the cement mills and quarries is unusually lively as a result of the long list of mills which hope to complete 1929 without an accident and the even longer list which has succeeded in avoiding all lost-time mishaps since the start of the annual no-accident campaign June 1.

While a number of the prospective trophy winning mills have closed for the year, most of them are still in operation, facing the extraordinary hazards of winter during the last few weeks of their race for the $1000 cast stone trophies awarded by the Portland Cement Association to the mills which avoid accidents during an entire calendar year. On November 15, the Portland Cement Association reports that there were 31 mills apparently free from accident and three more whose possible perfect records are open to question. Of the total, 14 have previously won trophies, 12 of them in 1928 and two previously but not in 1928.

The roster of what the cement mill organizations call the "Trophy Club," containing the names of all prospective winners, is shown below.

Monthly accident frequency figures covering all of the mills in the association membership continue low, as shown by the following table and curve. In August, for the first time since June, 1927, the month's accidents were more numerous than during the same month of the preceding year. For 26 months consecutively the accident frequency record has shown a lower rate each month than for the same month in previous years. It is possible that the August, 1929, figure may be sufficiently reduced in readjustments at the close of the year to bring it below August, 1928, although unlikely.



There were 667 lost-time and fatal accidents in these mills during the first ten months of 1929, as compared with 778 accidents of these classes during the corresponding period of 1928. If this reduction of about one-seventh continues until the close of the year, the total for 1929 should be under 800 and possibly it may drop as low as 750 when the final adjustments are made to the records.

ROSTER OF PROSPECTIVE WINNERS OF THE P. C. A. SAFETY TROPHIES FOR 1929

Company and Mill	Superintendent
Allentown Portland Cement Co., Evansville, Penn.	D. C. Morgan
Alpha Portland Cement Co., Bellevue, Mich.	G. A. Lawniczak
Alpha Portland Cement Co., Cementon, N. Y.	A. C. Brown
Alpha Portland Cement Co., Ironton, Ohio	F. C. Brownstead
Alpha Portland Cement Co., Manheim, W. Va.	W. L. Matthes
Alpha Portland Cement Co., Martins Creek, Penn.	John L. White
Bessemer Cement Corp., Bessemer, Penn.	D. C. McKee
Canada Cement Co., Ltd., Exshaw, Alta.	W. D. Armstrong
Consolidated Cement Corp., Mildred, Kan.	R. M. Johnson
Cowell Portland Cement Co., Cowell, Calif.	E. D. Barnett
Great Lakes Portland Cement Corp., Buffalo, N. Y.	A. T. BeVier
Hercules Cement Corp., Nazareth, Penn.	J. Stanley Downs
International Cement Co., Ltd., Spokane, Wash.	J. H. Neill
Lehigh Portland Cement Co., Birmingham, Ala.	R. H. MacFetridge
Lehigh Portland Cement Co., Iola, Kan.	C. A. Swiggett
Lehigh Portland Cement Co., New Castle, Penn., No. 3	W. H. Kleckner
Lehigh Portland Cement Co., Ormrod, Penn., No. 3	William J. Montz
Lehigh Portland Cement Co., Sandts Eddy, Penn.	James A. Gish
Lone Star Cement Co., Alabama, Spocari, Ala.	W. W. Deadman
Lone Star Cement Co., Alabama, Birmingham, Ala.	W. M. Cabaniss
Lone Star Cement Co., Louisiana, New Orleans, La.	J. J. Oakes
Lone Star Cement Co., Pennsylvania, Nazareth, Penn.	E. C. Champion
Marquette Cement Manufacturing Co., Cape Girardeau, Mo.	R. C. Matthews
Medusa Portland Cement Co., Toledo, Ohio	W. J. Worthy
Medusa Portland Cement Co., York, Penn.	R. J. Landis
Pacific Portland Cement Co., Redwood City, Calif.	M. J. Johnsson
Southwestern Portland Cement Co., Victorville, Calif.	L. V. Robinson
Trinity Portland Cement Co., Dallas, Tex.	O. V. Bartholomew
Trinity Portland Cement Co., Houston, Tex.	R. G. Sutherland
Universal Portland Cement Co., Duluth, Minn.	Ray S. Huey
Wabash Portland Cement Co., Osborn, Ohio	L. E. Palmer

The three following mills may also have a clear record, but are temporarily in doubt:

Atlas Portland Cement Co. (The), Independence, Kan.	C. M. Carman
Wabash Portland Cement Co., Stroh, Ind.	Glenn G. Hall
Wolverine Portland Cement Co., Quincy, Mich.	John Dieterman

MONTHLY ACCIDENT FREQUENCY IN THE CEMENT MILLS

	1924	1925	1926	1927	1928	1929
Mills reporting	110	120	124	134	136	153
January	280	249	197	133	63	60
February	284	232	183	108	76	53
March	280	252	198	140	91	46
April	285	236	171	152	101	77
May	271	234	174	110	82	76
June	271	92	204	59	42	41
July	317	231	199	105	77	80
August	285	227	198	124	80	85
September	237	215	181	123	88	77
October	240	259	187	131	78	71
November	177	200	164	94	87	....
December	207	182	165	88	48	....
Total for the year	3134	2609	2221	1379	913	....

Cement Mills to Have Safe Practices Code

AS THE result of a movement started by Maj. H. A. Reninger, recently president of the National Safety Council, for the compilation of a series of safe practices bulletins covering the various fields of cement mills and quarry practice, a committee of the cement section of the council has just made announcement of the series.

F. E. Town, superintendent of the Manitowoc Portland Cement Co., and recently chairman of the cement section; E. H. Parry, safety director of the Glens Falls Portland Cement Co. and present chairman of the section; A. J. R. Curtis of the Portland Cement Association, Major Reninger and Stewart J. Owen, safety engineer of the council, constitute the committee which planned the work. They have invited the cooperation of a number of technical and operating men of long experience who are preparing the manuscripts with the assistance of Mr. Owen, who is acting in an advisory capacity for the series.

The list of forthcoming safe practices pamphlets is as follows:

"Quarrying and Crushing," prepared by Felix Guenther, Jr., general superintendent, Pennsylvania-Dixie Cement Corp., Kingsport, Tenn. Mr. Guenther has had an active experience of over 31 years in cement plant and quarry operation, quarry prospecting and plant construction.

"Raw and Finished Milling," prepared by S. Henry Harrison, assistant superintendent, Vulcanite Portland Cement Co., Vulcanite, N. J. Mr. Harrison is known as one of the most proficient mill operators and student of cement mill safety problems for many years.

"Burning and Powdered Coal Handling," prepared by F. E. Town, superintendent, Manitowoc Portland Cement Co., Manitowoc, Wis. Mr. Town handles a powdered coal plant at Manitowoc along scientific lines as a result of several years' study of safe handling of this easily ignited highly explosive fuel. The kiln (burning) department at Manitowoc was chosen by the

Portland Cement Association for use in connection with its clinker investigations.

"Shops," prepared by J. H. Kempster, general superintendent, Buffington plant, Universal Portland Cement Co., Buffington, Ind. Mr. Kempster has the distinction of managing the largest cement plant in the world, combining three of the largest mill units. His shops are likewise the largest in the cement industry, providing experience with an unusual range of accident exposure. The paper is written, however, with small and moderate size shops always in mind.

"Storing, Packing and Shipping Cement," prepared by R. H. MacFetridge, superintendent, Lehigh Portland Cement Co., Birmingham, Ala. Mr. MacFetridge was invited to prepare this pamphlet as one of the best informed men in the industry on shipping problems and on general safety work.

"Yards and Railroads," prepared by J. R. Cline, assistant superintendent, Universal Portland Cement Co., Universal, Penn. Mr. Cline supervises one of the largest yard gangs in the industry and many miles of railroad. The efficiency with which they are handled and the almost complete wiping out of serious accidents have created a demand on Mr. Cline for the principles by which these results are possible.

"Power Department," prepared by H. A. Reichenbach, superintendent, Nazareth Cement Co., Nazareth, Penn. Mr. Reichenbach was selected as a member of the Portland Cement Association's committee on accident prevention two years ago and is known as a thorough student of power department problems.

All of these pamphlets are to be submitted in mimeographed form to all of the members of the cement section for reading and criticism, after which Mr. Owen, working in cooperation with the original authors, will undertake any necessary revision and editing. This plan, which has become standard in the preparation of the National Safety Council safe practices pamphlets, has proven very advantageous.

The first two pamphlets of the series to appear in mimeograph are "Quarrying and Crushing" and "Storing, Packing and Shipping Cement." Both of these, now in the hands of cement section members, are distinct contributions along these lines and reflect great credit on the authors, Messrs. Guenther and MacFetridge.

Nazareth Cement Company Conducts Successful Safety Campaign

By L. R. Rice

Safety Engineer, Nazareth Cement Co., Nazareth, Penn.

THE NAZARETH Cement Co. undertook a special safety campaign starting on May 1 and ending October 1, 1929. During June this campaign became a part of the annual no-accident month effort participated in by all of the cement mills and it is pleasant to report that during the entire five-month period covered by the drive there was not a single lost-time accident at the mill or quarry. The campaign was opened with a safety mass meeting at which 90% of the employes were present. Then a smaller meeting was held for the night shift, so that not a man would be missed. The leading speakers were Superintendent H. A. Reichenbach, who as a member of the committee on accident prevention of the Portland Cement Association, has taken special interest in the safety work of the industry; Fred B. Hunt, the plant electrical engineer, active in the work of the Lehigh Valley Safety Council, and several of the mill department heads. Similarly enthusiastic meetings were held on the first day of succeeding months.

Our organization has done its best to profit by every near-accident and every no lost-time accident. In every such case a committee has been appointed to make a thorough report with recommendations for avoiding the particular accident in the future. These investigating committees draft their reports in their own words, sign them and present them to the superintendent. Such committees usually consist of two foremen, two workmen and the safety engineer. After their report is made the superintendent acts immediately to prevent a recurrence and does not consider the matter closed until a satisfactory course of action has been found and carried out.

As the remaining months went by a variety of selected posters were used. The safety board was used during August. Seven special bulletin boards were erected in various departments and new posters placed upon them every week. On every occasion during the campaign when a near accident, or narrow escape, was reported, bulletins describing the occurrence were made immediately and posted on all bulletin boards. So much general interest was manifest in our boards that we kept them well posted with welfare, accident prevention and fire prevention news.

In addition to the monthly mass meetings mentioned above, we had workmen's meetings every two weeks. A surprising number of suggestions were made by the men at these meetings, largely, we feel, as a result of the work of the safety committee's inspection trips through the plant. These did much to arouse the interest and comment of the workmen.

A general foreman's meeting is held on the last Thursday of every month in the local Y. M. C. A., where the program includes a round table discussion on safety, dinner is served and after the meeting those present engage in bowling, quoits and other indoor sports. It is hoped also to use some safety films as there is a motion picture machine at the Y. M. C. A. We hope to have a machine of our own soon, so that safety films can be shown at our mass meetings and as often as desired at the plant.

Bulletin boards erected as part of the Nazareth Cement Co.'s successful safety campaign

Our 20 trained first-aid men proved a valuable factor in our compaign. These men, constituting four teams, were trained under the able instruction of the United States Bureau of Mines. Every other week two of the teams held a practice meeting in order to keep in good practice and improve wherever possible. These meetings alternated with the general employes' meetings, giving four enthusiastic meetings each month. In two instances during the campaign when trivial accidents involving no loss of time occurred, the first-aid men did fine work.

Dispensary One of the Best

The plant dispensary has been acknowledged one of the best in the Lehigh Valley district. A nurse is on duty during the entire day shift and is subject to call at night. Our organization has established what we believe to be an absloutely unique record in the avoidance of infections. We have had no infection case whatever since the starting of our safety work in 1925. This is not accidental, of course, but is the happy result of our educational efforts and our vigilance in caring for the smallest bruises, scratches and cuts. Our regulations demand that employes report at the dispensary in case of any injury no matter how trivial it may be; as a result we have had as many as 350 cases including 84 treatments and 174 dressings in a single month. These cases range anywhere from cuts to colds and other minor illnesses.

In order to make a complete check-up on our entire force every day during our recent campaign, I personally checked over each clock card every morning and was furnished with a report by each foreman making explanation for each absence. In our past experience men have been injured and have gone home without reporting at the dispensary, hoping that they would be recovered by the following day, but have found next morning that they were suffering from a severe injury. By checking the clock cards every morning we start an inquiry just as soon as such a man fails to show up at the plant and in that way get him quickly whatever is required for his speedy recovery.

Departmental Safety Flags

In addition to the safety flag of the Portland Cement Association we have flying over our plant three additional safety flags representing our three general divisions—yard, mill and quarry. These departmental safety flags are identical—consisting of a gold field carrying a white cross. On the center pole, above them all, flies the stars and stripes. Should an accident occur in one of these three departments, the flag representing that department would be lowered and the pole would remain vacant until the first day of the following month. The department is then given a green probationary flag to fly for one month, and if no furtheir accident is suffered, the gold and white flag is given back and placed on the pole on the first day of the following month.

H. A. Reichenbach, superintendent, Nazareth Cement Co.

About the only criticism we have had of our methods comes from a few who have thought that we hold too many meetings. On the contrary, we have found that the more safety is talked and the more good meetings have been held, the better our records have been and the more active and alert our men in avoiding accidents. We use the safe practice pamphlet book of the National Safety Council a great deal in our meetings.

When an employe brings up a situation involving some particular subject such as conveyors, saws or drag chains, I read what the safe practices pamphlets say on the subject and the problem is usually solved. We believe in meetings so strongly that frequently during our campaigns, when we would come upon a small group eating lunch at the pack house, quarry or some other place about the plant, we would take advantage of the chance to discuss with them a few of the high lights of the campaign in order to stir up more interest. In this way we reached again the men of every department and succeeded in arousing their enthusiasm.

The last lost-time accident occurred in our plant on April 16, 1929, and since that time we have succeeded in creating the longest accident-free period in the history of our company. Our employes are now better sold on safety than ever and they begin to realize from actual experience that our mill can and should operate without accidents.

We have the whole-hearted support of our general manager and superintendent, two absolute essentials for a really successful safety drive. Prepared as we are by the experience of the present year, our entire organization is resolved to complete 1930 without as much as single lost-time injury, in order that we may win the Portland Cement Association trophy. If others can do so, we firmly believe our mill and quarry force capable of doing as well.

Angeles Gravel Completes Ready-Mix Concrete Plant

THE Angeles Gravel and Supply Co., Port Angeles, Wash., has completed a 45-cu. yd. per hr. central ready-mixed concrete plant on its property. The mixing outfit is modern and equipped with both control devices, inundator, etc.

The first order for the new plant was for 18,000 cu. yd. to be used in the construction of the Olympic Forest Products Co.'s new mill.—*Port Angeles* (Wash.) *News.*

Plant safety committee at the Nazareth mill

Before and After Safety Training*

By H. Sergeant

Safety Engineer, Southwestern Portland Cement Company, Victorville, Calif.

THE degree of interest and of effort put into safety work today differs vastly from what it was a few years ago. Presidents, superintendents and those responsible for the operation of large concerns, have enlisted for the battle, supporting safety training and closely co-operating with their men in safety work of almost every kind.

Engineers have been instructed to lay out new buildings and other structures with particular stress on safety devices and ways and means of keeping out accidents. Hand rails, guards, and every conceivable protective device have been introduced until now it is our conviction that the greatest results are bound to come from personal training, that is teaching the men safe thinking and safe habits.

The Human Element

It is no small task for one man to keep the employes of any large concern keyed up so that each will do his part, and he must have their individual co-operation. Wrangling, envy and other difficulties chargeable to human nature are sometimes hard to overcome. All of these obstacles have to be taken into consideration in any campaign against accidents. We are putting every man through a rigid course of training. "Only the fittest shall survive," said Darwin, "and we're all here, aren't we?" That is our motto and we have decided to keep on living as long as possible, leaving no stone unturned, to put the inevitable far in the distance.

Let us go back five years and look over our lists of accidents. The reduction is amazing when the actual facts are before us. At no time, of course, was it any man's intention to purposely cause direct injury to himself, or to fellow workers. Thus we can safely say that the majority of accidents have been caused, not so much by indifference as by lack of education and training on how to keep out of trouble under modern industrial conditions.

A man's family relations may be considered for a moment as offering a good illustration. Often a mere trifle may start the day off wrong. At the breakfast table, his wife may have tried to convey to him in a roundabout way, that she was sorely in need of a new frock, as Mrs. Jones, her next-door neighbor, had had two to her one, and finally getting no enthusiastic co-operation, radically decides she will have one. He finally leaves for work, not even having a chance to take part in the argument; it has been settled. That morning, you may hear him talking, grumbling to himself, getting ready his speech of final decision that he knows he will never be able to even start. In walking from one job to another, he may be laying the law down so strongly, that you will see him suddenly disappear through an open manhole, and then reappear with a broken leg or arm.

We have taken home conditions into account. Our get-together meetings, picnics and other outings have afforded the opportunities for the men to bring their families right to the stage of action. There have been such noted speakers as Wesley Gebb of the Industrial Accident Commission at Sacramento, who dwelled on this subject to considerable extent. He convinced the women and children who were gathered together on this particular occasion, of the important part they play in keeping their fathers and husbands working safely.

Eye-Accidents Increase

Another item brought to my attention, was the relatively large number of accidents to the eyes. Many of these were minor accidents, in which no time was lost, but who enjoys having the doctor probe around for a piece of steel, or glass? Surely these occurrences were not from choice—so why have them? Our committee applied this simple reasoning and preventative work began immediately. We feared that the minor eye accidents might lead to more severe ones.

We have labored unceasingly to instill in the minds of our men the value of their sight, and have issued rules against working where there is any risk to the eyes, without the use of goggles. Some plants have furnished the goggles to their men. The cost of patching up eyes in years gone by far exceeded the cost of purchasing eye protectors, but we are now happy indeed to be able to state, that as small as the cost of goggles is, it far exceeds the cost of medical attention. Surely this fact is gratifying.

Minor Injuries Need Prompt Attention

In the past, several minor accidents have come to our attention where cuts, mere trifles they seemed, were not given prompt attention. I recall one case in particular. A man in our employ suffered an injury to his shin bone. It was in June during our 1927 No-Accident Campaign. It seemed his one object was to get through June, so he hobbled through. We had already received our certificate of merit from the Portland Cement Association for getting through the month safely. In July, this man's trouble got worse and finally to a degree where the man almost lost his leg. Long weeks of confinement and suffering resulted. Upon looking up our records, we found that the original accident had happened in June and we were obliged to return the certificate. How much easier it would have been to accept the hard luck when the mishap occurred than to receive the honors, pat ourselves on the backs as victors only to have it all taken from us.

Now we have an up-to-date first aid room. All departments are equipped with first aid kits. A man closely follows up each injury whether small or large and instead of 15 and 20 minor accidents a month, four is a large number and if I remember correctly, month before last, we came through with only one.

Occasionally we encounter a man with an uncontrollable temper. By this, I mean the fellow who is of the opinion, that a few unmentionable words and a right hard blow with a hammer will make a rail bend easier, or a bearing tighten up without further trouble. Did you ever see a man driving a spike and incidentally hit his finger instead and the next thing, the hammer flying in mid-air? Revenge, they say, is sweet, but do they really injure the hammer? No—the fellow working where the tool lands is the one to suffer. Imagine a plant with 200 employes of this temperament. Much of the time would be spent picking up human debris.

Beware of the "Sleep-walker"

Then, there is what is known as the sleep-walker, which brings to my mind a little saying I heard the other day and that is—"Everyone would be better off if they worked eight hours and slept eight hours, but don't do both in the same eight hours." A man has no conscience when looking for a place to rest while on the job. For this reason, we have put electric lights in all out of the way places, such as nice soft coal beds, damp and cool basements and warnings "Do not sleep" on conveyor belts which are apt to convey a sleeper to eternal slumber any minute.

We have all had experience with the clown on the job. He spends much of his time turning hand-springs, and popping wise-cracks which are not complete without the demonstrative gestures. Sometime he may be on a scaffold and walk off in one of his most excitable moments when he wants to be sure and get something uninteresting over.

To the above three classes of men, we can only say, that we have appealed to their inner selves. It is beyond human ability to help these men, if they will not help themselves. A man's bad temper may be due to indigestion, worry, unpleasant happenings. The sleep-walking habit may be resultant of late hours or mental disturbances, and for the over-exuberant being, we can only recommend more work, less talk and practice of self-control.

* Paper read at the Second California Safety Conference of the Portland Cement Association at Los Angeles, September 24, 1929.

We have endeavored to delve into these situations to the best of our ability. Insurance companies have helped with valuable literature and posters, and we have tried to point out to our men the gain to themselves as well as to the company and other workmen of practicing safety at all times.

Our efforts have not been altogether in vain. It is a never-ending work but by the application of patience we have brought the once numerous accidents down to a minimum. The companies are sparing no expense to accomplish "no accident" years. Man's vanity is well known. Flatter him and you may expect him to make great strides. Our monthly-safety bonus checks prove that. No man wants to be the center of attraction as having caused his team to lose, but who wouldn't readily step in front to be decorated for working over a long period without accident.

Skin Irritation Among Workmen with Cement and Concrete

IT HAPPENS occasionally that workmen subject to constant contact with cement or concrete suffer various forms of skin irritation, commonly classed under the general name of dermatitis. The manisfestations may be simply inflamed areas which look as if they had been burned; a rash, breaking out in small inflamed spots, eczema, palmer abscess, impetigo or furunculosis (boils). From an irritating rash the trouble may progress until large areas are swollen and infected. Because of great exposure, the hands and arms are the most frequent locations for the trouble although it also occurs frequently about the body. A great deal of interest has been manifested in this subject recently often indicating that the causes and remedies are not as generally understood as they should be.

Employes of packing and shipping departments in the cement mills, workmen employed in mixing and handling cement mortar, those engaged in grinding or using cement paints and concrete finishers and workers are all more or less exposed to the conditions which cause what is commonly referred to as cement dermatitis. However the great mass of those engaged in the occupations mentioned seem to have skin sufficiently rugged to resist the action of the cement, while the few with relatively tender skins are affected more or less unless they protect themselves by one or more of the methods which have been found effective.

Perhaps an explanation of the cause of the trouble under typical circumstances would be of interest. Cement particles are very small in size and very hard. Where permittted to rub on the skin their abrasive action is very great. If the worker perspires with cement particles on the surface of his skin, the perspiration and the cement may react to form larger and more irregular shaped particles to scarify and inflame the skin. This action may also stop up the pores in that way odding still further to the irritation.

There is a large amount of soluble lime in cement. When moisture is present a caustic solution is formed which will burn cuts, bruises and inflamed spots, the irritation being very severe in cases of delicate skin. This solution also removes the protective oil coating from the skin, causing it to become dry and likely to crack.

Trouble Greatest in Summer

The Aetna Life Insurance Co., in investigating dermatitis among cement and concrete workers, observes that workers suffer more from this trouble in the summer time, probably because perspiration causes the formation of the active cement solution, while without the aid of the moisture the dry cement would remain dormant. The Portland Cement Association finds that the trouble is confined practically altogether to the warm summer months.

The best general preventative for cement dermatitis is frequent bathing. Shower baths and scrubbing of the hands with soap and warm water as often as required to keep the pores free from dust may be relied on by any person with fairly hard skin, to furnish entire protection against these eruptions. The value of these general hygienic measures are already understood to a considerable extent and a large proportion of the cement factories have been equipped for some time with extensive shower and wash facilities. Provision of the same kind on large field concrete jobs in progress during the summer would be valuable.

Since the hands and arms usually suffer the greatest exposure it is advisable, in addition to keeping them clean, to protect them with suitable gloves and other covering. Canvas gloves are not sufficient and may even add to the difficulty by letting the dust or moisture come through, at the same time inducing more perspiration than otherwise. Tight leather, rubber or closely woven cloth gloves are recommended. The tighter all clothing is, the better. Workmen who walk in wet concrete must wear water-tight boots. Getting clothing or shoes wet provides moisture which may dissolve cement on the surface of the skin providing caustic solution which the wet clothing iritates by rubbing.

Simple but Effective Remedies

In Health Article No. 153 by the Aetna Life Insurance Co., an ointment made of the following ingredients is recommended as a protective coating which will replace the oil in the skin and prevent the latter from cracking:

Petrolatum (Vaseline) ....3 parts
Lanoline ....1 part

By bathing frequently, protecting hands and arms as indicated above, wearing clothing that will keep out cement dust and moisture and applying a suitable ointment or salve to exposed parts the probabilities of serious trouble with cement dermatitis are practically eliminated. Persons who suffer with skin eruptions from this source, notwithstanding the use of these preventatives should find occupation which avoids exposure to cement, lime and similar substances as well as wet concrete.

Portland cement is sterile and has no poisoning effect. Therefore any infection must be attributed to the entrance of foreign matter where the skin has become lacerated.

Blasting Operation at New British Cement Works

THE LARGE new cement works of G. and T. Earle, at Hope, in the English Peak district, near Sheffield, are now practically completed, and the first big blasting operations for obtaining limestone, the principal raw material, have just been carried out. A face of rock on the hillside overlooking Pin Dale was attacked, the area blasted being 700 ft. long, 35 ft. high and 10 to 15 ft. wide. One hundred charges of gelignite were placed, the total weight of high explosive used being 5600 lb. The work of drilling the holes for the charges occupied 70 men about six weeks. The vertical holes were 35 ft. in depth, and the horizontal ones 11 ft.

All the charges were fired simultaneously by electric ignition, and 30,000 tons of stone were displaced. The material thus yielded will justify an early start at the works. The jaw crusher which handles the stone from the quarry is said to be the largest machine of its kind ever constructed, and can crush as much as 280 tons of stone per hour.

Colorado River Development

THE Nevada Colorado River Commission with the assistance of the Bureau of Reclamation, the United States Geological Survey and George W. Malone, state engineer of Nevada, has prepared a compilation of all of the authentic data that has accumulated over a period of years relative to the water control of the Colorado river. The bulletin is known as Document No. 186 of the United States Printing Office, Colorado River Investigations, Water Storage and Power Development, Grand Canyon to the Imperial Valley.

Many volumes of reports have been reviewed, abstracted and indexed and included in this volume so that all important data may be immediately available without loss of time. The book includes photographs and maps of Boulder Canyon dam, Black Canyon dam, and others with the various reservoirs, canals, etc., that are a part of each proposal. Sources of aggregate, cement, etc., are also discussed.

Business Goes Back to Work

Stock Crash Will Retard Trade and Industry Only Temporarily

AMERICAN industry and trade, for the balance of the year and for the first quarter of 1930, will be retarded to some extent as the result of the upset in the stock market, but after that may proceed normally. The upset in security prices is having a sobering influence but it is not anticipated that this will adversely affect the general credit situation. Further, it is believed that money rates will become low enough to permit greater activity in building, public works construction and industrial plant expansion and modernization. This is the opinion of the business paper editors of the country as developed by a survey jointly conducted by the National Conference of Business Paper Editors and the Associated Business Papers. In this each editor reported on conditions and prospects as he saw them in the industry or trade with which his paper is concerned.

In the main these editors agree that as the result of the crash in stock prices business executives will work harder at their jobs and pay less attention to the stock ticker. Further, they hold that the prospects for 1930 are excellent for the businesses ready to apply the needed additional sales-effort drive, but only those companies which will extend themselves to the utmost will come through the coming year with profits up to the level of the last few years.

Industry Not Crippled

No trade or industry has been distinctly crippled by the sudden decline in stock market prices and many of the editors feel strongly that the result will be lowering of money rates generally and its return from the call money market to localized employment. None of them reports drastic reductions in production employment and all hold that the industries producing or merchandising goods in the luxury class will feel the adverse conditions first and be hit the hardest. On the other hand, they report that industry in general has not been over-producing and that stocks on hand of raw materials and finished products are low enough for whatever period of retardation may take place. The purchasing power of the general public may decline somewhat, but the business paper editors do not believe that this will reach serious proportions or last very long.

The status of production and distribution, as portrayed by the latest available figures, gives no sign of general drastic curtailment as a result of the stock market deflation. Such curtailments as are reported are in many cases the result of high money rates—which condition has now been corrected—or are the result of an over-production. General manufacturing as measured by the monthly consumption of electrical energy by the factories of the country in October was at a rate of 3.9% above October last year; the textile industry gave little indication of any reaction and October as a whole was a good month; engineering construction has declined steadily since May, the October lettings being 4% under October 1928; with money again available for mortgages building operations on a large scale are anticipated; sales of airplanes are slackening with the approaching winter season; demand in the machinery and machine-tool industry is holding up well; non-ferrous metal mines, mills and smelters continue active, although the stock market crash has adversely affected sales and prices; some curtailment in production will be witnessed in the radio industry, but this will not be general; unseasonable weather has slowed down business in the coal markets of the country; automobile production is being stringently curtailed, but the industry is financially sound; many important industrial developments and modernization projects are being announced; less luxury sales and more necessity buying is prevalent in the boot and shoe field; trade in the chemical industry is expected to slow up in the next few months; steel ingot production during October declined 7.4% against an average increase for the same period during the last five years of 3.9%; new financing in the electric light and power industry was materially decreased, the first nine months showing a decrease of 24% as compared with the same period last year, and October financing being 61% under October last year; agricultural conditions are sound, and farmers taken as a whole are optimistic for the first time in years; and financially the country was never stronger and money is again flowing into trade and industry and is available at reasonable rates.

Construction Stimulated

The railroads of the country, the editors feel, anticipate that freight traffic and earnings may be reduced but that by the middle of next year the stock market break will have a good effect on general business and railroad business in particular. In the building and construction field the editors are unanimous in holding that the break in stock prices will result in making investments in building operation distinctly attractive and that this after the temporary general decline is past will stimulate building and construction in all branches. Residential building, which has been much below normal for a year, will go ahead rapidly.

In the automotive industries the dealers are the ones who are bearing the brunt of any business reaction. Their stocks of new and used cars are exceptionally heavy for this time of the year, but opportunity to liquidate these before the first of the year will be afforded because the production by manufacturers will be comparatively small. Upon this liquidation depends the continued prosperity of the manufacturers, and leading manufacutring executives have definitely expressed the opinion that automobile production should be stringently curtailed for the balance of the year. Further, they favor controlling production during 1930 so as to keep it flexible and in accord with the automobile purchases of the general public.

Editors of the advertising journals who queried the chief national advertisers as to what effect the stock market crash would have on advertising schedules for 1930 report that these replies indicate no retrenchment in advertising expenditures. Some even contemplate additional advertising effort to force 1930 sales ahead and none indicates a disposition to consider the future with dread and expectation of general business depression.

George Duthie-Strachan

GEORGE DUTHIE-STRACHAN, former president of the Scully Sand and Gravel Co., Boston, Mass. (now part of the Boston Sand and Gravel Co.), died suddenly on November 12 at his home, 80 Waban Hill road, Chestnut Hill. He was born in Scotland May 9, 1870, educated in private schools and Edinburgh University.

He came to this country in 1900, becoming identified with prominent utility companies and enterprises, first as a public accountant and later as business counseler. He developed the Unit Methods Co. for handling the clerical end of various lines of business, a system now in wide use.

In addition to being president of the Scully company, he was president of the Hydraulic Development Co. of Boston, vice-president of the Standard Crayon Co. of Danvers, president of N. E. Mutual Service Co., Inc., director of Maurice, Inc., and president of Unit Methods, Inc. Some three years ago he was largely instrumental in forming a Newton civic organization, the Chestnut Hill Improvement Society.

He was a member of Revere Lodge, Boston Commandery, Aleppo Temple of the Mystic Shrine and other fraternal orders.

He is survived by his wife, Edith; a son, George, Jr., and a daughter, Christine, a pupil at Lasell Seminary, Auburndale.—*Boston* (Mass.) *Transcript*.

Concrete Floors

PAMPHLET No. 2, Concrete Floors and Footpaths, is a current issue by the Concrete Association of India, Bombay. It gives essential details of concrete floor construction, data on mixes and aggregates, etc.

Fire Causes $75,000 Damage to Sand Plant

EXPLOSION of an oil valve in the drying plant of the Diamond Grit Co, Philadelphia road near Summit avenue, Baltimore, Md., recently, is blamed for a fire which swept two of the company buildings, with a damage estimated at $75,000.

The fire spread rapidly from the drying plant to the screening plant. The principal damage was to machinery used in the fine screening of sand.—*Baltimore* (Md.) *Post.*

Portland Cement Association Re-Elects President

FOLLOWING a practice of several years' standing of keeping its president for two years, the Portland Cement Association, meeting at Chicago, Ill., November 19, re-elected Frank H. Smith president for a second term. Mr. Smith is president of the

Frank H. Smith, re-elected president, Portland Cement Association

Lawrence Portland Cement Co., New York City. The meeting was not as largely attended as in previous years.

At the mill section meeting on November 20 the principal topics of discussion were waste-heat power and quarry transportation. The papers read were "Relative Operating Costs with Waste Heat and Purchasing Power," by John J. Porter, vice-president and general manager, North American Cement Corp., Albany, N. Y.; "Locomotive Haulage in Cement Mill Quarries," by J. H. Legate, superintendent, Plant No. 5, Canada Cement Co., Ltd., Belleville, Ont.; "Aerial Tramway of the Superior Portland Cement, Inc." by H. A. Ambler, superintendent, Superior Portland Cement, Inc., Concrete, Wash.; "Electrical Haulage Operated by Remote Control," by A. C. Butterworth, electrical engineer, mining department, Pickands, Mather and Co., Duluth, Minn.

President Hoover Will Help Promote Construction

REPORTS to the press from Washington, D. C., in connection with the series of conferences President Hoover is holding with leaders of industry state: The President particularly is anxious that construction activities of the various industries shall be expanded, in line with his theory that construction work can be used to take up the slack in employment. Some of those who will participate in the conferences were associated with Mr. Hoover when he served as chairman of the conference on unemployment convened by the late President Harding in September, 1921.

Mr. Hoover expressed his views on this subject in a foreword to a report of the subcommittee on seasonal operation in the construction industries which was issued in April, 1924.

"Construction is the balance wheel of American industry," said Mr. Hoover at that time. "Activity in construction bears a close relation to general industrial conditions. The construction and equipment of new buildings result not only in the employment of building trades labor but in production of a variety of materials.

"The demand for construction thus to a large degree affects our economic stability."

Montreal Seeks to Control Quarry Blasting

RECOMMENDATIONS limiting quarry blasting practices within the city limits of Montreal will soon be made to the city council, according to a recent report. These recommendations if passed and enacted as bylaws will threaten the existence of city quarrying operations. In fact, their express purpose, as stated by one member of the city council, is "to force the quarrying industry to withdraw eventually beyond the city limits."

The proposed bylaws reduce the amounts of dynamite to be exploded at city quarries to such an extent that continued operation of these quarries becomes almost impossible. A competent man has been engaged to survey the situation, has made a report to the city council, and this report is now being considered. Complaints from the Rosemont and Villeray wards, in which it is alleged considerable property damage and constant danger of life and limb due to blasting, are the basis for the investigation.

Finishing Lime Manufacturers (Ohio) Elect Officers

THE ANNUAL MEETING of the Finishing Lime Association of Ohio was held Friday, November 15, at the Commodore Perry Hotel, Toledo, Ohio.

This association, claimed to represent 75% of the finishing hydrated lime production in the world, and producing approximately 50% of this country's production of hydrated lime, is strongly united through co-operative effort for the purpose of carrying on a national educational and promotional campaign towards the extension of the use of their product in construction, as well as the maintenance of the high standard of quality.

The program of work which was adopted for the coming year embraces publicity, advertising, field promotional work, research and educational work.

The following were elected to offices for the coming year: President, G. C. Urschel, the Woodville Lime Products Co.; vice-president, A. B. Mack, the Kelley Island Lime and Transport Co.; treasurer, L. G. Love, the National Lime and Stone Co.; secretary and general manager, L. E. Johnson.

The retiring officers who have served since the beginning of the association are: Fred Witmer, president, the Ohio Hydrate and Supply Co.; E. C. Swessinger, vice-president, the Kelley Island Lime and Transport Co.; G. H. Faist, treasurer, the Woodville Lime Products Co.

The following are members of the Finishing Lime Association of Ohio: the Gibsonburg Lime Products Co., Gibsonburg, Ohio; the Kelley Island Lime and Transport Co., Cleveland, Ohio; the National Lime and Stone Co., Findlay, Ohio; the National Mortar and Supply Co., Pittsburgh, Penn.; the Woodville Lime Products Co., Toledo, Ohio; Ohio Hydrate and Supply Co., Woodville.

Keystone Phosphate to Start Grinding Soon

PART of the machinery has arrived for a 500-ton mill to be installed on the property of the Keystone Phosphate Co., two miles from Paris, Bear Lake county, Idaho, and the grinding will begin soon, orders having been booked for deliveries on November 15, according to W. H. Honefenger, general manager. The property is owned largely by residents and former residents of Spokane.

"We are arranging for the installation of an aerial tramway to the Oregon Short Line railroad, a mile and a half distant, for transportation of the product," said Mr. Honefenger. "The property has been penetrated by a 1500-ft. double-track, electrically illuminated tunnel from which 1200 ft. of crosscuts have been driven and drifts run. A storage bin of 1000 tons capacity has been built and an electrically driven compressor and other equipment installed.—*Nampa* (Idaho) *Free Press.*

Oregon Royalty Tax on Gravel Is Upheld

MATERIAL removed from the bed of a river is the property of the state, and the contractor removing it may not use or dispose of such material without paying a royalty tax to the state, according to an opinion just handed down by Assistant Attorney General J. B. Hosford, in behalf of Attorney General I. H. Van Winkle.

The opinion was submitted at the request of the state land board. Representatives of the city of Independence had asked the board to remit the state royalty on gravel removed from a bar in the Willamette river, stating that unless the bar is removed the stream will be so diverted as to cause a menace to the city.

A gravel company had offered to take the gravel from the bar until such time as the government engineers were satisfied that the channel of the river had been controlled, on condition that no royalty be collected. The attorney general says that the board may not obstruct the work in any way, and the contractor may do the work at the instance of the federal authorities, or of the city, but the material removed cannot be disposed of without paying a royalty to the state.

Oppose Port Jefferson Sand Dredging Permit

LEADING residents and real estate owners around Port Jefferson, L. I., harbor have grouped in opposition to the granting of a permit for further dredging on the town lands under water in the harbor. It is charged that serious depreciation of waterfront estates would result if the application is granted.

The opposition is directed particularly at the application of the Great Eastern Sand and Gravel Co., a subsidiary of the Seaboard Sand and Gravel Co., for the right to dredge the underwater strip extending for about a mile along the inside of Setauket Beach, which comes from the Brookhaven Board of Town Trustees on November 19 at Patchogue.

The Great Eastern Sand and Gravel Co. has already one lease to land under water in the harbor from the present Board of Town Trustees, according to Arthur B. Reeves (creator of the Craig-Kennedy detective stories), which still has four years to to run. Under the terms of this lease the company pays the town 5 cents a cubic yard for every yard of sand or gravel taken out of the harbor.

In 1928, Mr. Reeves charged recently, the gravel company owed the town $4,500. He added that he has been unable to find any town records to show this back payment was ever made, although he had requested the information of the president and clerk of the town board.

But even if the payments were made, he contends, the return would not be sufficient to compensate the town for the loss of taxes it would sustain as a result of depreciation of property values.

William H. Robbins, prominent Bay Shore lawyer, has been engaged by those opposed to the grant to fight it.

At the present time the Great Eastern Co. is engaged in dredging a strip of about 200 acres of harbor bottom near the mouth of the channel. This work was started in 1924 under a grant by the board of trustees, which was renewed for another five years in February of this year, according to Reeves.

There are three gravel companies operating in Port Jefferson Harbor. In addition to the Great Eastern they are O'Brien Brothers, who are also dredging near the harbor mouth, and the Seaboard Sand and Gravel Co., which is the owner of a strip of gravel deposit on the upland on the eastern side of the harbor.

Sand dredges, according to Mr. Reeves, are accompanied with smoke, noise and oil as well as being generally unsightly. It is these factors, the protestants contend, which reduce property values wherever they operate. —*Brooklyn* (N. Y.) *Eagle*.

Fall of Ohio River Causes Dredge Damage

RAPID fall of the Ohio river recently resulted in heavy property loss in the vicinity of Portsmouth, the heaviest loser being the Portsmouth Sand and Gravel Co. through the grounding of much of their river equipment, including its sand pumping boat and two barges, the latter splitting in two, causing an estimated damage of approximately $10,000.

The water receded so fast, dropping back several feet within a few hours, that those in charge of the river equipment were unable to keep the craft afloat.

It is said that the sudden fall of the water was due to the raising of the wickets at Dam No. 30 near Greenup and Dam No. 31, just below the city, letting the water out of the pool in the Portsmouth district, without notice to rivermen, caused the disaster. —*Portsmouth* (Ohio) *Times*.

McCrady-Rodgers Sand Co. Adds 12 Steel Barges

THE McCrady-Rodgers Sand Co., Pittsburgh, Penn., will add 12 barges to its fleet this year. Four of these have just been delivered by the Jones and Laughlin Steel Co., six are to be delivered by the American Bridge Co. before the end of the year, and two by the Riter Conley Co.

The McCrady-Rodgers company is the combine recently formed between the McCrady Brothers and Rodgers Sand Co.—*Ambridge* (Penn.) *Citizen*.

New England to Promote Use of Agricultural Lime

A MEETING of New England lime and fertilizer manufacturers and agronomists was held in New Haven, Conn., on November 1 to find ways and means for increasing the use of lime in New England.

A joint committee was appointed representing the lime industry, the fertilizer industry and the extension services of New England States. This committee is organized with M. S. Hazen as chairman and J. B. Abbott as secretary. The first meeting of this committee will be held in Springfield, Mass., on November 25, at which time plans will be made for carrying on an aggressive campaign to promote the use of lime on New England farms.

Install Mixed Lime Mortar Plant at Milwaukee

A NEW 500-ton per day mixed lime mortar plant has been recently completed at Milwaukee, Wis., by the Lime Products Co., Benjamin Siegert owner and plant manager. The equipment, all electrically operated, is housed in a 70x35-ft. frame building.

Sand and lime in carloads are brought to a siding just south of the mixer and unloaded by means of a 75-ft. steel boom, electrically operated. The shovel loads to the plant by dropping material through the roof into a hopper or storage sand in the yard. —*Milwaukee* (Wis.) *Journal*.

Hahn-Muscatine Gravel Co. Assets Sold

LAND and buildings of the Hahn-Muscatine Co., insolvent gravel firm at Muscatine, Iowa, with the exception of the fixtures were sold to the Northern Gravel Co., Muscatine, for $9,052 and the machinery and equipment was sold to Al Thomas, who, it is said, was bidding for the W. G. Block Co. interests, for $7,000 at a bankruptcy sale in Davenport on November 4. The bids were accepted following several conferences.

Sale of the assets of the company was authorized by W. A. Newport, referee in bankruptcy, on September 7. The company filed its petition of voluntary bankruptcy July 15. For two years previous a receivership was maintained which was terminated by the local district court when bankruptcy proceedings were started.

The firm owned approximately 80 acres of real estate on Muscatine Island. Real estate and equipment valued at approximately $25,000 were listed when the sale was authorized. A number of local residents listed claims against the company when it entered bankruptcy. Assets of $27,190.66 were listed and liabilities set at $108,157.64 when the bankruptcy petition was filed.—*Davenport* (Iowa) *Times*.

Federal Trade Commission Hedges on Published Price Rules

TWO TRADE PRACTICE rules, one pertaining to publication of price lists by members of the steel fabricating and distributing industry, and another relating to the publication of the terms of sale, for the members of the plywood industry, have been reconsidered and modified by the Federal Trade Commission, the Commission announced November 11. Following is the announcement in full text:

The Commission has reconsidered and modified two rules adopted by industries in recent trade practice conferences. Both rules are Group II rules originally accepted by the Commission as expressions of the trade.

The reinforcing steel fabricating and distributing industry's rule 8, Group II, is changed to read as follows:

"The industry approves the practice of each individual member of the industry independently publishing and circulating to the purchasing trade his own price lists."

The rule formerly provided for circulating an individual member's current price lists and also notices of advances, declines or other changes in price.

The plywood industry's rule 14, Group II, now reads as follows:

"The industry hereby records its approval of the practice of making the terms of sale a part of all published price schedules."

The rule formerly provided also that "failure on the part of wholesale distributors or manufacturers to strictly adhere to such terms of sale and enforce collection under such is condemned by the industry."

Co-operation in Promoting Safety Urged by Quarry Section of National Safety Council

THE importance of securing the cooperation of all industries in order to promote safety was stressed at a meeting of the executive committee, Quarry Section, National Safety Council, held at the Pennsylvania Hotel, New York City, on October 24.

All of the trade associations represented in the Quarry Section are striving to decrease the number of lost-time accidents in their industries. The committee agreed that it was the duty of every trade association to endeavor to decrease accidents in the industries which they represent.

A committee of the Quarry Section was appointed to make a thorough investigation of the matter of preparing a safety manual to apply to the industries comprising the Quarry Section. This committee was instructed to submit a report as to the proper procedure for the Quarry Section to follow in promoting accident-prevention work in its industries.

At the beginning of the meeting, there was a general discussion concerning the return of injured men to their employment. It was pointed out that in safety contests the real objective is the securing of comprehensive information regarding lost-time accidents in American industry, and the mere winning of a trophy is of secondary importance. It was agreed that nothing but a strictly honest policy of reporting lost-time accidents will enable the Quarry Section in the National Safety Council to aid in the prevention of accidents.

It was the well considered opinion of the committee that all industries should be represented in the National Safety Council, and that a real need existed for securing new members. In this connection the chairman of the committee, A. L. Worthen, was authorized to communicate with the presidents of the associations representing the several industries composing the Quarry Section, with a view of pointing out to their member companies the advantages to be gained from affiliation with the National Safety Council in its accident prevention work.

W. W. Adams, in charge of the safety work of the U. S. Bureau of Mines, requested the assistance of the committee in increasing the enrollment in safety contests among the various industries composing the section. He gave a detailed report concerning the contests which the Bureau of Mines is now supervising, and emphasized the need for bringing every member of the industries into the contests in order that the Bureau may secure complete information regarding lost-time accidents in the industries involved.

Chairman Worthen informed the committee of the progress being made with reference to the preparation of safety posters. He said that these posters would probably be available soon, and that the associations composing the Quarry Section should cooperate in securing a full and efficient distribution of the posters among their member companies.

The next meeting of the committee will probably be held in Washington, subject to the call of the chairman. Those present at the meeting in New York were:

Committee Members

A. L. Worthen, vice-president and general manager, Connecticut Quarries Co., New Haven, Conn., chairman of the executive committee of the Quarry Section.

W. W. Adams, United States Bureau of Mines, Washington, D. C.

V. P. Ahearn, secretary, National Sand and Gravel Association, Washington, D. C.

J. R. Boyd, secretary, National Crushed Stone Association, Washington, D. C.

R. E. Colville, insurance manager, United States Gypsum Co., Chicago, Ill.

O. M. Graves, vice-president and general manager, the General Crushed Stone Co., Easton, Penn.

Wisconsin Mineral Aggregates Co-operative Association Cuts Prices on Sand and Stone

ACCORDING to the *Milwaukee* (Wis.) *Leader*, a substantial reduction in the price of sand, gravel and crushed stone to Milwaukee contractors will go into effect shortly, members of the Wisconsin Mineral Aggregates Co-operative Association having agreed to reduce the price of stone from $2.75 to $2 per cu. yd. and the price of sand from $2.50 to $1.85 per cu. yd., it was learned.

The reductions are the result of increased economy in operation through co-operative marketing and elimination of long hauls, the report states.

The reduction is especially gratifying to city officials in view of an increased price for cement which this year is offered to the city at an increase of 7 cents a barrel.

Indiana Limestone Co. Head Predicts Good Building Year

A. E. DICKINSON, president of the Indiana Limestone Co., declared recently that the building industry faces splendid prospects for the coming year. "There is a large government program, and state and municipal programs of substantial size," he said. "Banks, railroads and other corporations have programs for building which should swell the total to figures that may prove to be the largest in history. A falling off in building in recent months was due to the small volume of home building and apartment construction. Liquidation of the stock market should now bring about a resumption of this type of building, because large sums wil be available for good mortgage bonds. This company has orders for a larger amount of fabricated work today than ever before in the history of our business, and we are very optimistic over the future."

Rock Crusher Must Get Silencer

TO OPERATE within the law, the Hollywood Paving Co., Los Angeles, Calif., must equip its rock crushing machinery with silencers, City Prosecutor Lloyd Nix let it be known recently.

The prosecutor served notice on paving company officials that they will be prosecuted on a criminal charge of maintaining a nuisance at their plant at Beverly and La Cienega boulevards unless the noise is stopped.

A petition signed by more than 250 residents of the vicinity was filed at the prosecutor's office.—*Los Angeles* (Calif.) *Examiner.*

Pennsylvania Crushed Stone Producers Meet at Harrisburg

Meeting Called to Discuss Highway Specifications, Extent of Security Companies' Liabilities and Freight Rate Changes

ON NOVEMBER 7 the Pennsylvania Stone Producers Association held a special meeting at the Penn-Harris Hotel, Harrisburg, Penn., to discuss certain proposed changes in the state highway specifications for 1930 and other subjects of vital interest to the producers. About 25 members and guests of the association were present at the morning session, which was presided over by F. T. Gucker, president of the Pennsylvania Stone Producers Association, and P. B. Reinhold, secretary.

Mr. Reinhold opened the meeting by calling attention to the present more or less chaotic condition of the highway ballast specifications. Apparently there have been cases in that state where highway ballast of a certain size has been shipped and used satisfactorily, even though it did not comply with present specifications. The stone was what the user wanted and what he got, but recent changes in the highway board and its adoption of more exact sampling and screening practices have resulted in many instances where material that previously had been satisfactory is condemned by the inspector. Apparently the situation is such that a producer has no way of knowing whether or not his material will be accepted. Likewise exceedingly wide differences in sampling and screening methods exist between the shipper and inspector.

This proposed change or standardization of specifications led to a vigorous discussion as to its practicability from the stone producer's viewpoint and as to whether or not he could, without practically rebuilding his plant, meet those specifications.

Some were of the opinion that a committee should be appointed to confer with the highway department and try to bring about a specification that would be commercially practicable and acceptable to the producers and users alike. A resolution was passed authorizing the appointment of a committee of five to confer with the highway board. The committee was not named at the session.

Before adopting the resolution the chair tried to draw out from the members present ideas as to what they considered "practical, commercial and acceptable" specifications for No. 5 ballast, and there apparently were no two similar ideas on the subject; some thought that a 100% minus 5-in. product should be the maximum size and others thought it should be smaller, but most of the members believed a 4½-in. to 5-in. maximum size would be agreeable. However, nothing was definitely established, even though there was an emphatic expression from F. O. Earnshaw that the members should give and take so as to get their ideas on the subject in concrete, definite form, for as he said, "If we can't agree on a specification, how do you expect the highway officials and the producers to agree?"

The only definite specification they did agree on was that the top size of road stone should be the low size for No. 5 ballast. The present low size specification is 2¾ in. Some held that a 2½-in. low size would be better, but as was pointed out, the smaller the low size of ballast, the greater the tendency for segregation. Some of the producers apparently have had trouble with segregation and have found it necessary to trim their cars while being loaded.

Mr. Reinhold, the secretary, asked for an expression from the members present as to the desirability of mailing out the National Crushed Stone Association's Bulletins Nos. 4 and 6 by A. T. Goldbeck, director of the bureau of engineering. He pointed out that Pennsylvania was to build 1000 miles of concrete highway and 250 miles of macadam road during 1930 and that sending these bulletins to the various highway commissioners, engineers, etc., might be advisable, especially in view of the activities of competitive commodity producers. From the discussion that followed it was evident that a majority believed the national association was doing good work and that both national and local associations were necessary.

It was suggested that the association employ a paid secretary to work for the association's interests instead of depending on the use of bulletins to promote the cause of crushed-stone aggregates. To have a paid secretary it was thought that an income of at least $12,000 for the first year, in addition to the money already on hand, would be necessary. To raise that amount it was determined that a straight tonnage levy of 5 mills per ton would be necessary.

Mr. Reinhold pointed out that the sand and gravel operators in the Pittsburgh district had a promotional engineer and it was costing in the neighborhood of $15,000 per year to maintain that bureau although the engineer's activities were confined to an area having a radius of only 60 to 75 miles. No final action on this was taken at the meeting.

Highway Attorney Speaks

John L. Shelley, attorney for the Pennsylvania state highway department, gave a talk on the state highway surety bond in which he pointed out that under Act No. 490, of May 9, 1929, the bonding company could be held liable for debts which were contracted even though the debts incurred did not enter into a component part of the highway. Previous to this act the surety bond covered only materials that actually went into the highway's construction, such as cement and aggregate. He pointed out the necessity of an aggregate producer keeping adequate records of cars shipped to a particular highway job so that in the event of claims being filed later it may be readily proved that the material actually was used on that particular piece of highway. He also explained how the highway commission could hold up final payment to a contractor until his debts had been satisfactorily settled, provided the commission was notified that such money was due the complainant, and in the event the stone producer filed a complaint of this nature the highway commission would do all in its power to protect his interests.

Mr. Shelley pointed out that if all debts had been discharged, final payments would be made to the contractor, but that a surety bond was never released. Accepting a promissory note, he explained, implies a settlement of a debt and when a note has been given in lieu of cash, the highway commission must consider that debt discharged, making release of the final payment retroactive. If later the note should prove worthless the surety company could not be held liable. Therefore, he warned all aggregate producers to fight shy of notes. Under such cases he believed that a man's verbal promise was better protection to the stone producer, as such verbal promises did not release the surety bond.

A letter from James L. Stewart, secretary of highways, was read by Mr. Reinhold regarding the highway departments attitude towards overweights. The letter stated:

"It is not the intention of this department nor of the fiscal officers who pass on invoices before payment to withhold approval where only slight unavoidable overshipments are involved. It is, however, our intention to break up the practice of careless or intentional overshipments on the part of our vendors. If the stone producers in your association will watch this matter carefully and do all possible to eliminate overshipments, we will not withhold approval of their invoices when slight unavoidable overshipments are made."

Registration of Producers

Bellefonte Lime Co.: J. Linn Harris.
Bethlehem Mines Corp.: M. L. Jacobs, J. F. Tyson.
Carbon Limestone Co.: F. O. Earnshaw.
Dyer Quarry Co., John T.: F. T. Gucker.
General Crushed Stone Co.: H. B. Allen.
Samuel Given Quarries: Samuel Given, Edward A. Lanz.
Lake Erie Limestone Co.: William M. Andrews, W. W. Duff.
Lemoyne Quarries Co.: J. C. Fraim.
Millard, H. E.: D. B. Shroyer.
New Castle Lime and Stone Co.: Ellwood Gilbert.
North American Cement Corp.: R. V. Cearfoss.
Northampton Quarrying Co.: R. E. Graul.
Reinhold, Paul B.: Reinhold & Co.
Stowe Trap Rock Co.: Nicholas Cascetti.
Susquehanna Stone Co.: John Caldwell.
Warner Co.: R. F. Hoggan, Sam Newpher.
Winston and Co.: C. C. Hartsock, W. I. Jones.

Small Quarries Sold to Weston and Brooker Co.

SALE of the A. T. Small quarries at Holton, Ga., a few miles north of Macon in Monroe county, to the Western and Brooker Co. of Columbia, S. C., for $25,000 cash was ordered by Judge Bascom S. Deaver in federal court at Atlanta, Ga., recently. W. W. Jamison, vice-president of the Weston company, stated in open court that the quarries will be reopened shortly if conditions are found to be feasible.

The small quarries were ordered sold under foreclosure proceedings filed by Herbert Pearson, receiver of the defunct Fourth National bank of Macon. The properties were valued at $182,378.72 on the books of the bank.

The original bid of the Weston and Brooker Co. was $17,500 made in July. This was refused by the comptroller of currency and a sale at public outcry was ordered for October 15. At that time the highest bid submitted was for $22,500 by the Birmingham Rail and Locomotive Co. of Birmingham, Ala. The properties were thereby sold to the Birmingham concern subject to confirmation of the comptroller and Judge Deaver.

Subsequent to the sale the Weston company made an offer of $25,000 and Judge Deaver ordered a hearing at which time each side was ordered to show cause why the bid of the other party should not be accepted.

After the plans of the Weston and Brooker Co. had been outlined the petition of the Birmingham concern was withdrawn and Judge Deaver ordered the quarries sold to Weston and Brooker, it was learned.—*Macon* (Ga.) *News.*

Cushing Company Acquires New Acreage

A PROPERTY on the Amsterdam road about half a mile from Scotia, N. Y., formerly owned by Louis Larabee, was purchased recently by the Cushing Stone Co., James E. Cushing, president. The plot includes about 45 acres upon which are gravel deposits which might be worked. The company's new property is near the old gravel pit on the Amsterdam road. The consideration involved could not be learned.—*Schenectady* (N. Y.) *Gazette.*

Big Gravel Dredge Sinks After Mystery Explosion

ONE of the large dredges operated by the Standard Gravel Co. on the Ouachita river, three miles north of Camden, Ark., sank during the night of October 25 from unknown causes. Officials of the company believe that it was dynamited, although no positive proof can be secured until the boat, with the machinery, is raised.

Several thousand dollars worth of machinery, which was to be used in the operation of the plant, was on the dredge. The plant was to have started operations shortly, it was said by John Sanders, president of the company. The plant is valued at $85,000.

The night watchman said that he heard a dull explosion and when he went to the river's edge to see what was the trouble someone shot at him. County officers are working on the case, but have no clues. No reason for such dynamiting has been found, and the boat may have sunk when some part of it gave way.—*Little Rock* (Ark.) *Gazette.*

Dixie Company Adds New Steel Barges and Towboat

PURCHASE of a powerful all-steel towboat and a fleet of six huge new all-steel barges by the Dixie Sand and Gravel Co., Chattanooga, Tenn., was announced by W. H. Klein, vice-president of the company. The company is a subsidiary of the Penn.-Dixie Cement Corp. The new all-steel fleet will represent an investment of approximately $150,000.

The towboat is said to be the most powerful ever operated on this section of the Tennessee river. The barges are also said to be the largest ever used in the district. The steam towboat will be able to handle barges carrying a total of more than 2000 tons at a speed of from six to eight miles an hour against the current of the Tennessee river.

The towboat has only such quarters as are necessary for the crew, being designed and built solely as a work boat. It will be powered with a 500-hp. steam engine driving its stern wheel. Steam will be generated by four boilers. The towboat will have a length of 146 and a width of 30 ft. It will draw 42 in. of water. The boat is now being constructed by the Howard Shipbuilding Co. of Jeffersonville, Ind.

The barges, which will measure 30x130 ft. and draw 7 ft. of water under full load, have been ordered from the Nashville Bridge Co. of Nashville. Each barge will have a capacity of 650 tons of sand and gravel. Both towboat and barges will be delivered to the Dixie company in May.

The company is making the large expenditure to insure the necessary handling equipment for an adequate supply of sand and gravel used in construction work at Chattanooga in the future. The company was also influenced to go into the bigger and more powerful equipment by the fact also that it is now having to go downstream to a point below Hales bar for its sand and gravel.

With the new all-steel fleet the company will have two towboats and 12 barges. The wooden barges are gradually being replaced by the all-steel equipment. The plan is for the present towboat to do switching below Hales bar while the new boat will handle the barges to Chattanooga.—*Chattanooga* (Tenn.) *News.*

A. C. O'Laughlin Co. Bought by Consumers Co.

THE Consumers Co. has arranged for purchase of the properties of A. C. O'Laughlin Co., crushed stone producers and building material dealers. Part payment will be made with $2,000,000 of prior preferred series A stock and also voting trust certificates representing 80,000 shares of common.

This purchase is part of the consolidation program which it is understood the Consumers Co. was contemplating. At an earlier date, it was said that the company had taken options on the O'Laughlin Co., Wisconsin Lime and Cement Co. and the Central Lime and Cement Co. (ROCK PRODUCTS, September 28, 1929, p. 121.)

Late in September the stockholders of the Consumers Co. paved the way for this transaction with their approval of an increase in the authorized common stock to 3,000,000 shares of $5 par value from 1,000,000 shares. No increase in the authorized amount to prior preference stock was necessary.

Rockland-Rockport Lime Plant to Use By-Product Fuel

ACCORDING to President George B. Wood of the Rockland and Rockport Lime Corp., the corporation has made a contract whereby the By-Products Fuel Co. of Boston is to construct a plant on the lime company's property at the north end for the production of pig iron and valuable by-products obtained from the gasification and combustion of bituminous coal. One of these by-products will be a large quantity of fuel gas which will be used for burning lime in the kilns of the lime corporation.

A similar contract has been made by the By-Products Fuel Co. for the construction of a plant in Cambridge, Mass., where the gas will be used as fuel in the brick kilns of the New England Brick Co.

These two plants will be pioneer installations of this particular process in the United States. The process is common practice in Scotland, where it has been carried on for a great many years.—*Boston* (Mass.) *Globe.*

Fort Worth Opens New Gravel Plant

FORMAL opening with hundreds of visitors present marked the inauguration of operations at the new gravel plant of the Fort Worth Sand and Gravel Co., Fort Worth, Texas. The opening was marked by a barbecue which was attended by business associates of H. P. Bonner, president.

The plant was designed by R. M. Quigley, treasurer. It is at Hurst Station and surrounded by 3,000 acres of gravel land. Six grades of gravel are produced at the plant, which has a daily capacity of 100 carloads.—*Fort Worth* (Texas) *Press.*

Portland Cement Output in October

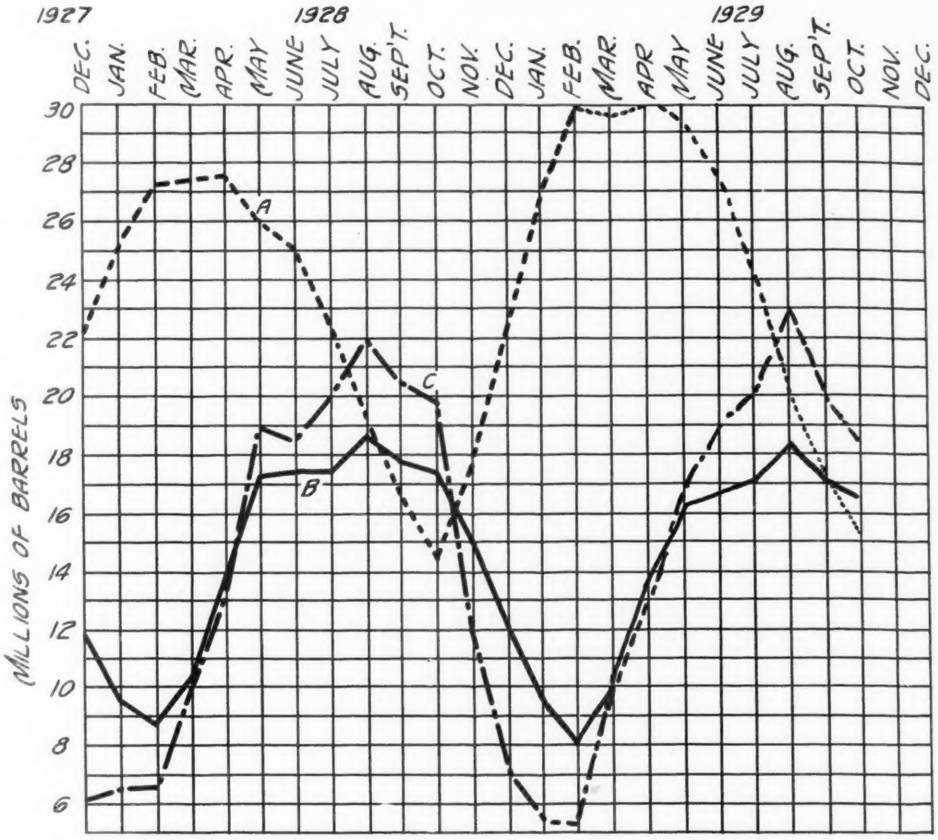
THE portland cement industry in October, 1929, produced 16,731,000 bbl., shipped 18,695,000 bbl. from the mills, and had in stock at the end of the month 15,361,000 bbl., according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in October, 1929, showed a decrease of 4.6% and shipments a decrease of 5.8%, as compared with October, 1928. Portland cement stocks at the mills were 5.4% higher than a year ago.

The statistics here presented are compiled from reports for October, from all manufacturing plants except two for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants at the close of October, 1929, and of 159 plants at the close of October, 1928. In addition to the capacity of the new plants which began operating during the twelve months ended October 31, 1929, the estimates include increased capacity due to extensions and improvements at old plants during the period.

RELATION OF PRODUCTION TO CAPACITY

	Oct. 1928 Pct.	Oct. 1929 Pct.	Sept. 1929 Pct.	Aug. 1929 Pct.	July 1929 Pct.
The month	87.1	77.0	81.8	86.1	80.4
12 months ended	73.8	67.3	67.5	68.2	68.9



(A) Stocks of finished portland cement at factories; (B) Production of finished portland cement; (C) Shipments of finished portland cement from factories

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during August and September, 1928 and 1929.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN AUGUST AND SEPTEMBER, 1928 AND 1929, IN BARRELS*

Shipped to—	1928—August	—1929	1928—Sept.	—1929
Alabama	315,341	271,466	255,120	179,011
Alaska	382	2,105	277	282
Arizona	57,033	57,184	56,940	56,000
Arkansas	150,173	187,688	136,794	206,476
California	1,166,958	1,007,181	1,020,406	915,829
Colorado	147,267	105,397	140,150	91,602
Connecticut	279,631	241,126	233,257	206,737
Delaware	29,447	56,135	34,578	34,281
District of Columbia	83,353	125,732	81,703	107,654
Florida	105,108	100,975	98,859	88,730
Georgia	181,254	160,279	155,421	117,262
Hawaii	25,413	26,037	21,378	24,896
Idaho	45,284	26,051	30,886	27,375
Illinois	2,581,921	1,969,576	2,553,958	1,721,624
Indiana	804,868	990,059	847.440	909,295
Iowa	813,328	1,108,711	738,450	968,958
Kansas	233,127	338,052	272,461	332,819
Kentucky	216,674	205,597	211,690	176,115
Louisiana	125,319	172,697	112,202	171,673
Maine	71,721	79,258	79,289	94,201
Maryland	260,189	323,021	227,573	294,089
Massachusetts	308,837	365,297	315,939	356,318
Michigan	1,707,324	1,891,753	1,692,432	1,601,684
Minnesota	401,260	533,434	377,096	430,298
Mississippi	122,486	131,963	129,970	107,651
Missouri	541,927	896,327	554,767	748.870
Montana	66,954	89,417	59,124	77,505
Nebraska	127,833	270,919	159,659	224,168
Nevada	14,101	12,186	13,635	14,180
New Hampshire	69,903	116,275	72,947	75,573
New Jersey	878,977	958,357	884,759	825,204
New Mexico	43,079	29,932	27,552	21,621
New York	2,774,981	2,768,232	2,398,193	2,237,801
North Carolina	218,950	149,085	167,910	129,411
North Dakota	61,931	47,870	43,739	49,597
Ohio	1,549,784	1,364,665	1,410,196	1,207,197
Oklahoma	286,023	371,205	361,360	365,927
Oregon	175,733	124,852	132,521	122,669
Pennsylvania	1,699,137	1,710,648	1,519,073	1,632,356
Porto Rico	....	6,995	500	4,190
Rhode Island	71,291	101,278	77,316	81,919
South Carolina	152.387	89,733	108,575	64,446
South Dakota	62,440	55,114	58.274	83,173
Tennessee	323,794	481,869	353,282	358,182
Texas	690,901	877,463	515,419	697,091
Utah	65,376	57,547	49,468	73,952
Vermont	103,293	181,612	108,095	135,894
Virginia	214,602	205,771	173,104	161,521
Washington	408,566	310,711	291,994	305,056
West Virginia	166,289	209,590	166,816	164,543
Wisconsin	809,545	952,914	791,171	759,187
Wyoming	30,976	26,480	27,555	24,015
Unspecified	30,779	49,633	41,593	22,207
	21,873,450	22,993,454	20,392,866	19,888,315
Foreign countries	96,550	58,546	67,134	61,685
Total shipped from cement plants	21,970,000	23,052,000	20,460,000	19,950,000

*Includes estimated distribution of shipments from three plants each month.

PRODUCTION AND STOCKS OF CLINKER, BY MONTHS, IN 1928 AND 1929, IN BARRELS

Month	1928—Production	—1929	Stock at end of month 1928	Stock at end of month 1929
January	11,839,000	12,041,000	9,672,000	9,642,000
February	11,363,000	11,255,000	12,237,000	12,436,000
March	12,501,000	12,450,000	14,463,000	14,948,000
April	13,844,000	14,166,000	15,002,000	15,472,000
May	16,025,000	15,445,000	14,329,000	14,911,000
June	15,940,000	15,312,000	12,944,000	13,586,000
July	15,981,000	15,180,000	11,707,000	11,619,000
August	16.202,000	15,822,000	9,357,000	*8,989,000
September	15,909,000	*15,147,000	7,566,000	*6,985,000
October	15,782,000	15,520,000	5,944,000	5,914,000
November	14,930,000	....	5,953,000	....
December	13,426,000	....	7,422,000	....

*Revised. †The inclusion of Wyoming begins with April, 1929; of Idaho, with June, 1929. of Arkansas, with September, 1929.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN OCTOBER, 1928 AND 1929, AND STOCKS IN SEPTEMBER, 1929, IN BARRELS

District	Production 1928—Oct.	—1929	Shipments 1928—Oct.	—1929	Stocks at end of month 1928	1929	Stocks at end of Sept. 1929*
Eastern Penn., N. J. & Md.	3,743,000	3,571,000	4,753,000	4,043,000	4,011,000	3,980,000	4,452,000
New York and Maine	1,204,000	1,129,000	1,375,000	1,407,000	1,102,000	996,000	1,274,000
Ohio, Western Penn., W.Va.	2,120,000	1,731,000	2,294,000	2,176,000	1,985,000	2,240,000	2,685,000
Michigan	1,550,000	1,437,000	1,673,000	1,323,000	757,000	1,075,000	961,000
Wis., Ill., Ind. & Ky.	2,238,000	1,935,000	2,646,000	2,346,000	924,000	1,329,000	1,740,000
Va., Tenn., Ala., Ga., Fla., La.	1,561,000	1,306,000	1,576,000	1,419,000	1,619,000	1,498,000	1,610,000
East'n Mo., Ia., Minn., S.D.	1,599,000	1,718,000	1,705,000	1,870,000	1,466,000	1,273,000	1,426,000
Western Mo., Neb., Kan., Okla. and Ark.†	1,190,000	1,331,000	1,361,000	1,508,000	993,000	621,000	798,000
Texas	617,000	777,000	552,000	743,000	346,000	527,000	492,000
Colo., Mont., Utah, Wyo.† and Idaho†	199,000	323,000	282,000	346,000	304,000	451,000	475,000
California	1,177,000	1,179,000	1,257,000	1,183,000	687,000	937,000	941,000
Oregon and Washington	335,000	294,000	362,000	331,000	385,000	434,000	471,000
	17,533,000	16,731,000	19,836,000	18,695,000	14,579,000	15,361,000	17,325,000

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1928 AND 1929, IN BARRELS

Month	1928—Production	—1929	1928—Shipments	—1929	Stocks at end of month 1928	1929
January	9,768,000	9,881,000	6,541,000	5,707,000	25,116,000	26,797,000
February	8,797,000	8,522,000	6,563,000	5,448,000	27,349,000	29,870,000
March	10,223,000	9,969,000	10,135,000	10,113.000	27,445,000	29,724,000
April	13,468,000	13,750,000	13,307,000	13,325,000	27,627,000	30,151,000
May	17,308,000	16.151,000	18,986,000	16,706,000	25,984,000	29,624,000
June	17,497,000	16,803,000	18,421,000	18,949,000	25,029,000	27,457,000
July	17,474,000	17,281,000	19,901,000	20,295,000	22,580,000	24,525,000
August	18,759,000	18.585,000	21,970,000	23,052,000	19,374,000	20,056,000
September	17,884,000	17,223,000	20,460,000	19,950,000	16,799,000	*17,325,000
October	17,533,000	16,731,000	19,836,000	18,695,000	14,579,000	15,361,000
November	15.068.000	....	11,951,000	....	17,769,000	....
December	12,189,000	....	7,384,000	....	*22,918,000	....
	175,968,000	....	175,455,000	....	....	....

PRODUCTION AND STOCKS OF CLINKER (UNGROUND CEMENT), BY DISTRICTS, IN OCTOBER, 1928 AND 1929, IN BARRELS

District	1928–Production	–1929	Stocks at end of month 1928	1929
Eastern Pennsylvania, New Jersey and Maryland	3,265,000	3,202,000	867,000	962,000
New York and Maine	1,103,000	1,045,000	627,000	441,000
Ohio, Western Pennsylvania and West Virginia	1,856,000	1,578,000	530,000	476,000
Michigan	1,303,000	1,350,000	527,000	465,000
Wisconsin, Illinois, Indiana and Kentucky	2,122,000	1,779,000	217,000	367,000
Virginia, Tenn., Alabama, Georgia, Florida, Louisiana	1,445,000	1,205,000	719,000	603,000
Eastern Missouri, Iowa, Minnesota and South Dakota	1,444,000	1,657,000	292,000	499,000
W'n Missouri, Nebraska, Kansas, Oklahoma and Arkansas†	1,089,000	1,286,000	303,000	190,000
Texas	570,000	793,000	112,000	293,000
Colorado, Montana, Utah, Wyoming† and Idaho†	222,000	283,000	315,000	274,000
California	1,089,000	1,059,000	1,156,000	944,000
Oregon and Washington	274,000	283,000	279,000	400,000
	15,782,000	15,520,000	5,944,000	5,914,000

EXPORTS AND IMPORTS

(Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.)

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII, AND PORTO RICO, IN SEPTEMBER, 1929

	Barrels	Value
Alaska	2,251	$ 6,779
Hawaii	21,382	53,762
Porto Rico	5,816	13,156
	29,449	$73,697

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN SEPTEMBER, 1929

Imported from	District into which imported	Barrels	Value
Belgium	Florida	4,500	$5,208
	Massachusetts	47,498	58,456
	New York	5,000	5,895
	Oregon	4,395	5,696
	Philadelphia	4,800	6,030
	Porto Rico	14,002	22,466
	Washington	1,000	1,410
	Total	81,195	$105,161
Canada	Maine & N. H.	322	$763
Denmark	Hawaii	6,149	8,988
France	New York	1,000	2,022
Germany	Los Angeles	950	1,754
United K'gd'm.	New York	22,756	33,551
	Grand Total	112,372	$152,239

Australian Cement Association

A RECENT announcement in the *Sydney* (Australia) *Herald* states that the Australian Cement Manufacturers Association has been registered under the Companies Act as a limited liability company. Among its members are the Commonwealth Portland Cement Co., Ltd.; Australian Cement, Ltd.; Sulphide Corp., Ltd.; David Mitchell Estate; National Portland Cement, Ltd.; the S. A. Portland Cement Co., Ltd.; Adelaide Cement Co., Ltd.; Queensland Cement and Lime Co., Ltd.; Tasmanian Proprietary, Ltd., and Kandos Cement Co., Ltd.

The manager of the association states that its object is to extend and improve the uses of cement and concrete, and that 10 competing cement manufacturers with plants in Queensland, New South Wales, Victoria, Tasmania, and South Australia are cooperating in support of the organization as a joint service and promotional institution. It is further stated that the association will base its educational and promotional endeavor on two decisions: (1) "The users' interests shall be paramount," and (2) "facts only shall be used." The association, it is added, is to have no actual part in the manufacture or sale of cement, and has nothing to promote but an idea, "of a wider, better and more economical use of cement."

A large company, Southern Portland Cement, Ltd., with works in course of construction at Berrima, N. S. W., has not as yet joined.

The association represents invested capital of about £7,000,000. The capacities of the various plants reached 1,000,000 tons of cement per annum, but at present the sales of cement do not exceed 750,000 tons yearly.

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES, IN SEPTEMBER, 1929

Exported to	Barrels	Value
Canada	7,269	$ 28,706
Central America	18,553	39,476
Cuba	5.223	15,040
Other West Indies and Bermuda	4,950	14,006
Mexico	19,896	63,323
South America	24,778	114,957
Other countries	5,599	33,123
	86,268	$308,631

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1928 AND 1929

Month	1928—Exports Barrels	Value	—1929 Barrels	Value	1928—Imports Barrels	Value	—1929 Barrels	Value
January	56,400	$204,875	78.639	$283,002	236,771	$315,797	151,302	$177,976
February	62,828	221,620	58,886	225,590	164,408	217,525	118,930	123,123
March	74,983	265,719	69.079	235,164	235,930	330,074	131,909	112,788
April	61,676	205,882	64,145	218.316	249,458	324,371	89,668	114,281
May	70,173	236,005	57,955	219,366	190,509	256,872	200,646	267,854
June	59,536	201,313	96.055	287,612	266,537	359,637	203,545	228,170
July	83,759	291,055	71,992	247,177	112,887	151,877	182,098	199,960
August	88,736	302,866	60.013	225.762	259,975	358,471	183.938	199,403
September	71,995	252,843	86,268	308,631	173,439	226,295	112,372	152,239
October	62,137	246,010	....	....	152,210	226,909	....	....
November	69,313	260,310	....	....	65,969	89,732	....	....
December	63,120	250,204	....	....	175,992	233,300	....	....
	824,656	$2,938,702	....	....	2,284,085	$3,090,860	....	....

Texas Cement Production and Shipments Increase in October

DURING October, production of cement in Texas reflected a gain of 10%, according to Bervard Nichols of the Bureau of Business Research, University of Texas.

"This is the largest amount that has ever been turned out in any month in the state, but in making comparisons allowance should be made for production from new plants put into operation during the past summer," Mr. Nichols said. "Moreover, a seasonal gain from September to October is the normal trend of production in Texas. In contrast to an increase, the industry for the entire United States shows a decline between the two months.

"A total of 777,000 bbl. were produced by Texas mills in October, against 707,000 bbl. in September and 617,000 bbl. in October, 1928. Shipments gained nearly 10%, or from 680,000 bbl. in September to 743,000 bbl. in October. Last year in October, 552,000 bbl. were loaded. Stocks increased seasonally from 492,000 bbl. on October 1 to 527,000 bbl. on November 1. Even though stocks made but a moderate gain during the month, they are nearly double those of last year at this time.

"No improvement was noted in demand for cement during the month and markets weakened a little. Prices remained unchanged. The basic price on November 1 was $2.15 per bbl. in Dallas and $2.25 per bbl. in Houston. Ten cents per bbl. discount is allowed for cash and 40 cents for cloth sacks where returnable."

Foreign Abstracts and Patent Review

Chemical, Microscopic and X-Ray—Photographic Examination of Alit. A. Guttmann and F. Gille state that American investigators conceive alit to be a tricalcium silicate, whereas German investigators consider it to be a mixed crystal or a mixture of various substances. The different conceptions are primarily due to the absence of a satisfactory analysis of the alit.

The authors attempted to obtain the alit crystal in the purest possible condition, by selection of clinker manufactured in actual cement production. In order to eliminate an accidental result, the alit was obtained from two clinkers having the greatest possible difference in composition. The chemical analysis (by per cent) of these two clinkers was as follows:

	Clinker G	Clinker O
SiO_2	17.62	22.7
Al_2O_3	6.63	5.4
Fe_2O_3	2.22	3.1
Mn_2O_3	2.61	0.1
CaO	65.82	67.4
MgO	3.17	1.2
SO_3	1.79	0.1

The slides of clinker G showed a well developed alit with only celit and a little glass; those of clinker O showed these and also belit. As determined by the White method, the clinker O contained no free lime; but the clinker G, adjusted for an excessive lime content, showed a clear to strong lime reaction. Clinker G had also an unusually high manganese content (2.6% Mn_2O_3) as compared to normal portland cement.

The alit was separated in both samples by centrifugal action in a centrifuge; the throughs of the 254-mesh sieve suspended in liquids of high specific gravity (methyline iodide and mixtures of acetylene tetra bromides) were centrifuged. The purity of the preparations was determined microscopically and also by the colorimetric method. Best densities for the suspension liquids were from 3.06 to 3.11 for clinker G and 3.10 to 3.15 for clinker O. From the first the alit was obtained as free as possible of the light aluminate and from the other as free as possible of the heavy celit. That the specific gravity of alit is greater is indicated by the centrifuging of considerably dried preparations. Its density was about 3.2 in both cases.

The percentage analysis of the fractions of alit eliminated from the clinkers G and O was as follows:

	Clinker G	Clinker O
SiO_2	22.70	24.51
TiO_2	0.30	0.10
Al_2O_3	3.50	2.06
Fe_2O_3	0.55	1.23
Mn_2O_3	0.71	0.10
CaO	69.87	70.84
MgO	1.63	0.92
Na_2O	0.56	0.25
SO_3	......	......

The alit still contains small portions of foreign constituents, and especially celit, to which iron and manganese and also a large portion of alumina and a smaller portion of magnesia are added, being fixed to lime. In order to get a clear conception of the composition of alit, allowance for celit has been made in both analyses. For clinker G the celit has been deducted by the formula:

$1.2\,MgO \cdot 4.6\,CaO \cdot 1.6\,Al_2O_3 \cdot 1\,(FeMn)_2O_3$

and for clinker O by the formula:

$0.6\,MgO \cdot 4.6\,CaO \cdot 1.6\,Al_2O_3 \cdot 1\,(FeMn)_2O_3$

After the celit is deducted, the following molecular relation results:

	—For alit from—	
	Clinker G	Clinker O
$\frac{CaO + MgO + Na_2O}{SiO_2 + Al_2O_3 + TiO_2}$	$\frac{3.11}{1}$	$\frac{2.99}{1}$

Based on similar calculations, the molecular relationship for clinker G is $\frac{3.31}{1}$ and for clinker O, $\frac{2.83}{1}$.

The tricalcium silicate $\frac{3CaO}{1SiO_2}$ is then shown to be the main constituent of the alit, upon the basis of the following molecular relation figures for the corrected alit analysis:

	CaO	MgO	Al_2O_3	SiO_2
For alit G	3.19	0.03	0.05	1
For alit O	3.00	0.04	0.02	1

The rational composition of the two clinkers G and O and of the alit fractions eliminated from them is now represented as follows in per cent of weight:

		—Alit fraction from—		
	Clinker G	Clinker G	Clinker O	Clinker O
Tricalcium silicate, $3(Ca, Mg, Na_2)O \cdot (Si, Ti)O_2$	66.9	86.7	93.1	70.5
Celit	19.1	5.4	5.0	12.1
Tricalcium aluminate, $3CaO \cdot Al_2O_3$	4.4	5.5	1.9	5.7
Free lime (CaO)	5.4	2.4	......	......
Bicalcium silicate, $2CaO \cdot SiO_2$	......	......	......	11.9

The examination with a microscope showed the alit fractions to be hexagonal plates or thick prisms with an indicated cleavage vertically to the first center line. The refractive index for α_{N^n} was ∞ 1.718 ± 0.002 and for γ_{N^n} ∞ 1.722 ± 0.002. The double refraction was ∞ 0.005, the optical character negative and the axial angle small. The auxiliary constituents were found to consist of celit and some aluminate with more of the aluminate in alit G than in alit O. From the relation of 3:1 of the bases to the acids, as determined by chemical analysis for the main constituent of the clinker, it was concluded by microscopic examination that this relation is designatory for the main constituent of the clinker, the alit; thus, in alit there is essentially tricalcium silicate.

The fact that tricalcium silicate was found to be the essential constituent of the alit was verified by the photographic examination of the alit fractions by the use of x-rays. The preparations were enclosed as sticks in cigaret paper and exposed to copper radiation for a considerably shorter period than given by Harrington for molybdenum radiation. Precision exposures were also made. For the alit fraction G the common exposure was 13 hours and the precision exposure 13 hours; for the alit fraction O the exposures were for 5 and 10 hours, respectively.

The authors refer to the work of L. T. Brownmiller and W. C. Hansen (Journal Amer. Cer. Soc., No. 11, 1928) as supporting the existence of the tricalcium silicate, although they give its optical character erroneously as positive. The lines of the x-ray pictures correspond with a slight exception to those given by Brownmiller, in both numerical value and strength. An identity of the bicalcium silicate with the tricalcium silicate could not be established with the x-ray photographs. Observance of the preparation in ultra-violet light did not reveal the fluorescence so characteristic of the bicalcium silicate. The authors then prove why they can reject the conception of Jaenecke that alit is either a bicalcium silicate or Jaeneckeit, or a mixed crystal of these two.

The results obtained in these investigations can be made useful in the preparation of early high strength cements, particularly high-limed cements; in order to determine whether the limit value of the lime in the portland cement has been reached or exceeded the following formulas are used:

1. If a percentage analysis shows $Al_2O_3 \geqq 0.64\,(Fe_2O_3 + Mn_2O_3)$ %, then the formula below is used:

$$\frac{1.07\,CaO - (0.38\,[Fe_2O_3 + Mn_2O_3] + 1.76\,Al_2O_3 + 0.75\,SO_3)}{SiO_2} \leqq 3$$

2. If the percentage of $Al_2O_3 < 0.64\,(Fe_2O_3 + Mn_2O_3)$ %, the formula

$$\frac{1.07\,CaO - (1.17\,Al_2O_3 + 0.75\,[Fe_2O_3 + Mn_2O_3 + SO_3])}{SiO_2} \leqq 3$$

is used.—*Zement* (1929), **18**, 30.

Effect of Temperature on Aggregates in Concretes. Dr. K. Endell determined the changes in linear expansion of portland cement concrete prepared with different kinds of aggregates and subjected to increasing temperatures. These tests show that in making concrete structures which are to be subjected to temperatures as high as about 1292 deg. F., siliceous aggregate materials should

be avoided as far as possible because of their sudden expansion at 1067 deg. F.; materials of this kind include quartz, flint, sandstone, granite, quartz bearing crushed brick. Instead, aggregates of a lower and more uniform expansion should be used, such as basalt, diabase, solid limestone (not coarsely crystalline limestone with its greater expansion), and also Mansfield copper slag and blast furnace slag. Of all aggregates investigated, only the blast furnace slag and the portland cement mortar made from it show up to 2192 deg. F. a completely uniform and comparatively small expansion; practically no gases appear and the coarse and fine structure undergoes practically no change in heating.—*Zement* (1929), **18**, 36.

Anhydrite Cement and Its Properties. P. P. Budnikoff summarizes the properties of anhydrite cement, presenting considerable data relating to all stages in its production. A mixture of sodium bisulphate and copper sulphate has been found to be the best catalyzer for the preparation of anhydrite cement. The anhydrite cement can also be regenerated without addition of catalyzers. Mechanical strength of anhydrite cement is decreased by the addition of CaO and the strength fluctuations over a period of time are said to result from the formation of an unstable complex hydrate.—*Zement* (1929), **18**, 31.

X-Ray Studies of Cements. H. W. Gonell tabulates data and gives the results of his x-ray examination of specimens of set alumina cement, "sanded off" alumina cement, and calcium carbonate. These data are further proofs that the "sanding off" of an alumina cement is caused by the formation of calcium carbonate as a result of the influence of the atmospheric carbonic acid. The calcium carbonate is eliminated as a calcite-shaped crystal.—*Zement* (1929), **18**, 32.

Chemical Reactions in Portland Cement Mortar. Dr. G. Kathrein deals with the chemical correlation between portland cement and the aggregate materials, which have seldom been considered. The chemical-physical reaction ability of rock substances in cement mortar was examined in 1927 with special attention to the influence of the substances of the aggregate in regard to free lime in cement mortar. Hydrated portland cement contains unfixed hydrate of lime, so-called "free lime," formed by decomposition of lime bearing compounds. This lime should not be confused with the free lime which results from shortcomings in clinker manufacture or from unhydrated cement and which causes lime blowing. It is the calcium hydroxide of the set cement which reacts with the natural or artificial pozzuolanas. The disintegration of cement concrete through detrimental solutions starts mostly with the conversion of the free lime.

TABLE 1. PER CENT OF FREE LIME BY WEIGHT IN 5-WEEK-OLD MORTARS SUBJECTED TO DIFFERENT PRETREATMENTS

	PRETREATMENT		
Storage	35 days in damp air at room temperature	14 days in damp air at room temperature; 15 days, at 8 hours, at 70 deg. C., and 6 days at room temperature	33 days in damp air at room temperature; 2 days, at 5 hours, at 20 at. (284 lb. steam pressure in the autoclave)
Drying	Several hours after the 35th day		
	PER CENT OF FREE LIME BY WEIGHT		
Portland cement mortar, 1:1	8.49	5.34	7.19
Quartz	4.26	2.62	......
Pumice stone	1.07	0.49	......
Orthoclase	4.38	(3.33)	(0.51)
Augit	4.26	2.74	3.19
Calcite	4.28	2.62	3.58
Kaolin	3.06	1.42	......

The author reviews the researches of H. Passow, Emley, White and others, respective to determination of free lime. It was then attempted to employ the amount of free lime content in mortars as proof of chemical reactions between binding agents (portland cement) and aggregate materials. The two methods of Emley and White, excellently specified for investigation of non-hydrated cements, are applied to hydrate products. Various minerals were prepared as fine dust and used in preparing specimens under exactly uniform conditions. The results by the Emley method are given in Table 1. The results obtained with the White method check quite well with them, as indicated in Table 2.—*Zement* (1929) **18**, 36, pp. 1098-1102.

Determining Disintegration of Concrete With the Stereoscopic Microscope. A microscopic examination shows very often how far a concrete has been damaged chemically. This examination is supplemented with tests for determining the strengths. The composition of the disintegrating elements can be determined by chemical analysis and the crystal formations examined with a miscroscope.

The textural condition of the concrete has thus far not been examined with the microscope, although the stereoscopic microscope is specially suited for this purpose. The elimination of crystals within the concrete can be determined with it easily and this is true of the blown fissures, which have already destroyed the texture of the concrete. These blown fissures must not be confused with the fissures which are due to shrinkage.

Dr. Gruen used the stereoscopic microscope in examining samples of concrete obtained from the submerged mole at Heligoland. This concrete was placed in the years 1909 to 1916; some of the samples were still sound and others showed disintegration. The damaged concrete showed a lower volume weight and in general a greater absorption of water due to the broken texture.

The mixing relation of the concrete cannot be determined from the content of insoluble constituents, but merely the relation of soluble to insoluble constituents. The examination shows that the mixing relation alone is not the determining factor for the preservation of the concrete in sea water. The sieve analysis of the sand which was used in the concrete showed that there was an excessive percentage of fine sand, as is true of most concretes.

The analytical examination shows that an increase in magnesia or sulphate is frequently characteristic of a disintegration that has already occurred or is still in process; but this is by no means an indication, for concretes which show no increase in magnesia or sulphate have been found to be disintegrated or in the process of disintegration. On the other hand, there are also concretes, especially those of cements having a low content in lime, which show and which permit high magnesia and sulphate contents without being damaged.

The results of the stereo-microscopic examinations show that the presence of gyp-

TABLE 2. FREE LIME IN 5-WEEK-OLD CEMENT MORTARS AND CONCRETE

(Determined by the A. H. White method to check the results obtained by the Emley method as given in Table 1)

Binding agent:		PRETREATMENT —Findings with the phenol-nitrobenzine solution— Room temperature	70 deg. C.	20 at. steam pressure
Portland cement	1.	10 min.	12 min.	7 min.
	2.	rapid	rapid	rapid
	3.	strong, frequent	clearly, frequent	strong, frequent
Mortar 1:1 :quartz	1.	18 min.	25 min.	....
	2.	rapid	rapid	....
	3.	very strong, frequent	strong, frequent	....
Pumice stone	1.	20 min.	30 min.	....
	2.	clearly,	clearly	....
	3.	clearly, sporadic	clearly, very sporadic	....
Orthoclase	1.	16 min.	14 min.	....
	2.	very rapid	very rapid	....
	3.	very strong, very frequent	strong, very frequent	....
Augit	1.	20 min.	20 min.	12 min.
	2.	very rapid	very rapid	very rapid
	3.	very strong, very frequent	strong, very frequent	very strong, very frequent
Calcite	1.	13 min.	18 min.	31 min.
	2.	rapid	rapid	rapid
	3.	very strong, frequent	strong, frequent	very strong, frequent
Kaolin	1.	15 min.	23 min.	....
	2.	very rapid	slow	....
	3.	strong, frequent	clearly, sporadic to frequent	....

1. First appearance of calcium phenolat crystals.
2. Growth of these crystals.
3. Development after 2 hours.

sum or calcium aluminum sulphate is not always a proof of the impending disintegration of a concrete. Cements which have a low lime content can withstand the presence of salts without being disintegrated.—*Tonindustrie-Zeitung* (1929), **53**, 58, 59.

Physical Chemistry of the Silicates. In his new book (Physikalische Chemie der Silikate; Leop. Voss, Leipzig; 552 pp., 459 ill.; RM. 63), Dr. W. Eitel presents a thorough study of the chemistry and physics of the silicates for the ceramic glass and cement industries. He deals with the state of the silicates, the thermo-chemistry of the silicates, the bases of the statics, dry silicate systems, the special silicate sytems, the systems of silicates and volatile substances, and adds a special chapter on the technical silicate systems, comprising technical glasses and slags, ceramic pastes, cements and mortars. The extensive bibliography of the silicate-industrial fields makes this textbook a good reference work for both theorist and practician.—*Tonindustrie-Zeitung* (1929), **53**, 47.

Why Cement Specimens Crack and Scale in Cold Water Testing. It has been assumed that the cracking and scaling of the surface layer of cement specimens prepared for determining volume consistency in cold water testing is due to or indicative of blowing. Dr. Haegermann arrived at different conclusions in testing five normal setting cements. If the specimens are immersed in water before or shortly after they start to set, the surface layer cracks but slightly and does not scale. No cracks appear on the surface layer, if the cement pat is immersed while the setting reaction takes place. There is considerable cracking and scaling when the pats are immersed shortly after the end of the setting period, determined by the Vicat needle. Then, again, there is no cracking and scaling if the pats are immersed several hours after the end of the setting process.

In view of further tests to be made, the following explanation is given: In preparing the pats and also the setting samples in the hard rubber ring an aqueous layer is first formed upon the surface. This layer contains hydrate of lime and soluble salts (alkali salts and gypsum) and solidifies quicker than the cement mortar beneath it, due to the influence of the carbonic acid of the air.

If the cement pats are immersed in the cold water as soon as prepared, diffusion sets in, varying the content of lime and soluble substances of the surface layer, so that differences in setting conditions occur, resulting in cracking of the surface layer after the layer beneath it has started to set.

If the pat is immersed just before the start of the set, the slight loss in water, absorption of carbonic acid from the air and loss in lime with consequent differences in surface tension cause the cracks to appear much sooner. Pats immersed during the setting process show no cracks, indicating that the lime combining action within the pat is more vigorous during the setting reaction than the force of the adjustment in concentration.

When the cement pat is immersed shortly after termination of the set, the resistance to diffusion and to differences in swelling of the very brittle surface layer and the body by way of matting and cementing is not sufficient to prevent considerable cracking and scaling.

If the pats are immersed several hours after termination of the set, the cementing of the surface layer with the body of the pat is sufficiently resistive to overcome the influences of diffusion and differences in tension.—*Zement* (1929), **18**, 36.

Alumina Cements. An abstract of the results of the researches of Pierre Boyer on the composition and chemical constitution of alumina cements as represented in full at the Congress of Industrial Chemistry at Paris, 1927.—*Revue des Materiaux de Construction et de Travaux Publics* (1929), 238.

Portland Cement Industry in Spain. P. Palomar gives the qualities of the Spanish portland cement, the amounts produced, tabulated details on companies, centers of production and plans for expansion. The great increase in the volume of cement required for public works in Spain has led to additions to existing plants and to the building of new plants, including the projection of a plant at Zaragoza and one at Puerto de Sta. Maria (Cadiz), so that production is expected to reach 2,000,000 tons within less than two years, as compared to the estimated 1,500,000 tons for 1929.—*Cemento* (1929), **I**, 1.

Utilization of Dolomite. A. Krieger describes the uses, properties, composition, burning and chemical relations of the dolomites.—*Tonindustrie-Zeitung* (1929), **53**, 20.

Properties of Cementa and Mortars. O. Graf in a new book (Zementverlag G.m.b.H., Charlottenburg, 1928, price, 3 R.M.) on cement mortars and concretes has compiled data on the compressive strength, flexural strength, shrinkage and expansion, resistance to abrasion, permeability to water and resistance to chemcial action, in reference to various granular compositions and to various additions of water to the mortar. The results, supplemented by many illustrations and tables, were based on thorough investigations made at the material testing laboratory of the higher technical school at Stuttgart.—*Zement* (1929), **18**, 26.

Waste Heat Utilization and Dust Recovery at a European Cement Mill. Four rotary kilns, each 131 ft. long and 6.9 to 7.9 ft. dia., are in use at a European cement mill. Production per kiln is about 660 bbl. per kiln per 24 hr. The waste kiln gases are passed to constantly cleaned waste heat boilers, having a heating surface of 3875 sq. ft. each for the kilns III and IV, and of 6677 sq. ft. for kilns I and II; their steam production is 11,000 and 13,220 lb. per hr. at 265 lb. pressure. The gas volume to be purified is about 28,252 to 31,783 cu. ft. per kiln at 392 deg. F. temperature. The dust thus reclaimed in the electric precipitation plant back of the waste heat boiler amounts to about 18 to 20 tons per kiln, or 10% of the raw material supplied to the kilns. This reclaimed dust is returned to the kilns.

Because of the constant cleaning of the waste heat boilers, the electric dust precipitation plant receives a uniform volume of gas and dust, thus improving its purifying efficiency. Delivery of the purified gases to the stack is independent of natural draft conditions and at velocities desired because of the use of a stack fan. The waste heat boilers produce about 3500-kw., sufficient power for the cement mill and the neighboring community of 2600 people.—*Tonindustrie-Zeitung* (1929) **53**, 46.

Russian Cement Industry. The official industrial program of Russia for the years 1929-1933 includes the building of 27 new cement plants of 26,000,000 bbl. total annual capacity to supplement the 28 existing plants of 14,000,000 bbl. total annual capacity now operating at nearly 100% capacity. The rationalization of the industry includes the installation of rotary kilns of new design and large capacity, with consequent fuel economies. An improvement in working conditions will be made.

The quarrying and conveying of the raw materials is to be fully mechanized by introducing power excavators, up-to-date drilling equipment, power locomotives, etc. Most of the cement plants are to be serviced from local central stations. By mechanising the operating processes and more efficient utilization of fuels and labor, output is expected to be increased 2½ times and costs lowered about 34.5%. A great increase in production will increase the working force by 59% in 1933 as compared with 1928. The plants produce principally high quality cement so that there is a great shortage of cheaper cements, but by 1932 the shortage in cement is to be met by domestic production.—*Zement* (1929) **18**, 21.

Process for Burning Cement. One or more nozzles are arranged in a semi-circle at the discharge or upper end of the kiln for feeding the raw mix or the slurry in a fine spray into the fire. The kiln lining is thus well protected against the high temperatures of the kiln.—*Zement* (1929) **18**, 26.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Aluminous Cement. The process consists of burning mixtures of aluminous ma-

terials and lime with which are incorporated small quantities of alkaline salts, the purpose of the latter being chiefly to burn the mix to a complete reaction without bringing it to the melting point. As an example the two following compositions are given: (1) bauxite 100 kg., lime 100 kg., sea salt 5 to 10 kg.; (2) bauxite 100 kg., lime 100 kg., calcium fluoride 5 to 10 kg.

The materials are crushed and thoroughly mixed with or without water. The burning is done in any oven, smelting, clinkering or preventing the mixture from reaching the melting point.

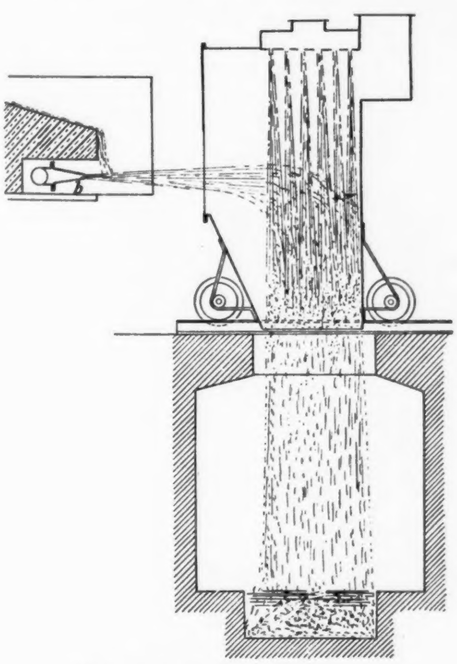
By means of the incorporated salts it is possible to obtain in a single burning below the melting point aluminous cements of a clear color which harden very rapidly. The color of cements, clinkerized or melted, changes from light gray to black-gray, the binding being then slower than in the case of unmelted cements.

By incorporating in the mixtures a sufficient quantity of lime to obtain ferric hydraulically binding products and without reaching the melting point, the cement is richer in hydraulically binding products. The added salts equally facilitate the reactions in this case and a single burning is enough.

The aluminous cements prepared as above described produce mortars which are not decomposed by sea water or hard waters. Mortars obtained with unmelted cements may be dipped a few minutes after preparation.—*Ernest Martin*, U. S. Patent No. 1,716,527.

Disintegrated Alumina—This invention relates to a method for making disintegrated alumina from melts and covers a device for carrying out the process and also covers special uses of the products thus formed.

The present invention is based on the discovery that molten alumina shrinks considerably producing small crystals when solidification is carried out quickly. The granulation by quenching is known, but at the extremely high temperatures (about 2000 deg. C.) local superheating of the water and the production of oxyhydrogen gas often results so that explosions may take place.

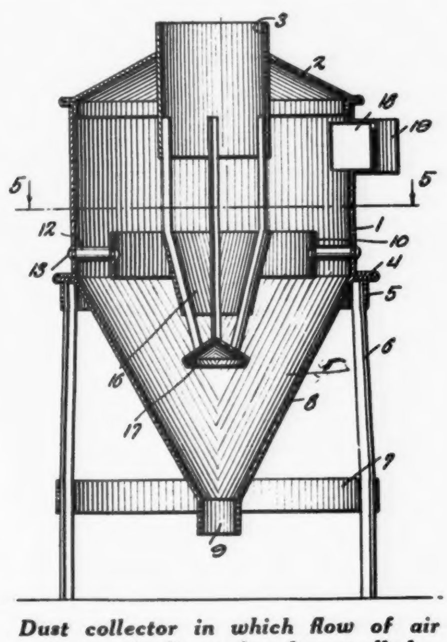


Molten alumina mixed with air is sprayed into water for distintegration

The authors propose to spray the molten alumina mixed with air into a body of water for secondary cooling, in such a manner as to prevent the forming steam from coming in contact with the molten alumina and being decomposed.—*Conway von Girsewald, Hans Siegens and Martin Marschner, Germany, assignors to Metallgesellschaft Aktiengesellschaft, of Frankfort-on-the-Main, Germany.*—U. S. Patent No. 1,704,599.

Dust Collection. A new type of dust collector has the exterior appearance of a cyclone, but it contains members by which the flow of the air current is directed and controlled.

The dust laden air is admitted tangentially to produce a whirling current in the usual way. The dust forced to the side falls into the cone below through a passage formed by the casing and a narrow ring and the air flows to an inverted cone frustrum and thence to the outlet pipe.



Dust collector in which flow of air current is directed and controlled

A small, flat cone hung over the center of the collecting cone has the purpose of directing the air upwardly to the outlet. Presumably it would also tend to prevent the raising of dust, already settled, by vortical action.—*T. S. Monaghan*, **U. S. No. 1,723,-703.**

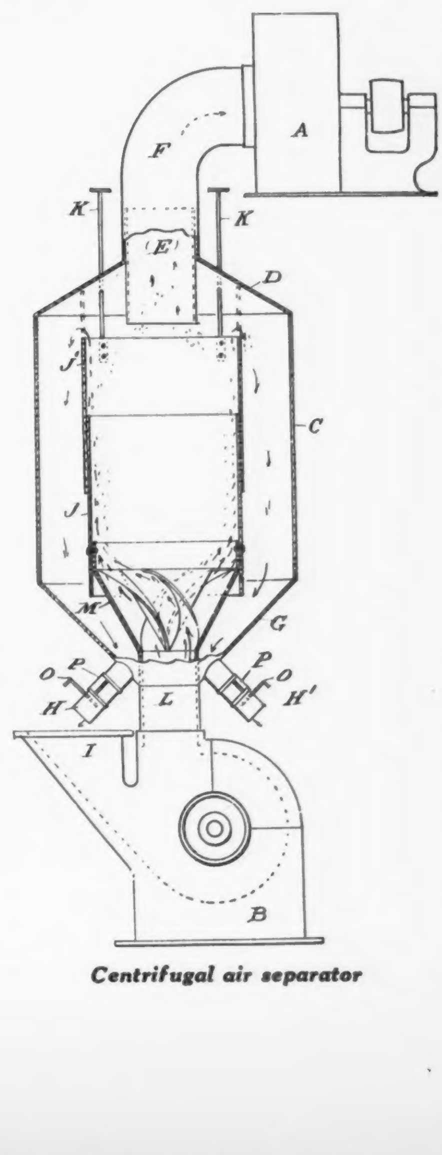
Wallboard Manufacturing Process. Apparatus for making wallboard with foamaceous material which comprises means for folding a strip of covering material into a continuous forwardly travelling narrow trough, means for supporting said trough in upright position, its long closed edge being down and its long open edge up, and means for pouring body material into said trough through the long open top edge thereof.—*Caleb Payne, Assignor to Gypsum Eng. and Mfg. Co., Chicago, U. S. Patent No.* 1,721,972.

Air Separation. A new type of centrifugal separator is shown mounted on a pulverizer of the swing hammer type. A suction fan draws the discharge of the pulverizer through the separator.

The separator has an outer casing within which is a cylinder that may be moved up and down to change the separation. The discharge is drawn into this through curved vanes that give a whirling motion to the air current. This sends the coarse particles to the wall of the cylinder while the fine particles rise in the center and are pulled out by the suction fan.

The coarse particles are worked up to the top of the cylinder where they are outside of the pull of the fan so they go over the edge and fall down into the casing.

The casing is made relatively large to serve as an expansion chamber. Since some air is exhausted from the casing, means for admitting fresh air are provided at the outlets through which the coarse particles are discharged.—*H. M. Plaisted,* **U. S. No. 1,724,041.**



Centrifugal air separator

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended Oct. 19	Limestone Flux Week ended Oct. 26	Sand, Stone and Gravel Week ended Oct. 19	Sand, Stone and Gravel Week ended Oct. 26
Eastern	3,634	2,936	16,589	12,986
Allegheny	4,098	3,462	10,615	9,763
Pocahontas	431	413	1,567	1,243
Southern	1,141	859	9,563	9,208
Northwestern	1,410	909	8,751	6,775
Central Western	604	589	12,899	11,784
Southwestern	561	579	8,943	9,460
Total	11,879	9,747	68,927	61,219

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1928 AND 1929

District	Limestone Flux 1928 Period to date Oct. 27	Limestone Flux 1929 Period to date Oct. 26	Sand, Stone and Gravel 1928 Period to date Oct. 27	Sand, Stone and Gravel 1929 Period to date Oct. 26
Eastern	129,092	144,875	489,187	493,736
Allegheny	148,479	155,160	326,482	318,352
Pocahontas	20,193	16,384	35,396	43,053
Southern	25,210	25,557	457,504	382,910
Northwestern	57,608	49,198	290,421	277,276
Central Western	19,134	22,556	444,853	458,596
Southwestern	17,778	21,497	271,738	297,910
Total	417,494	435,227	2,315,581	2,271,833

COMPARATIVE TOTAL LOADINGS, 1928 AND 1929

	1928	***1929***
Limestone flux	***417,494***	***435,227***
Sand, stone, gravel	***2,315,581***	***2,271,833***

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning November 16:

SOUTHERN FREIGHT ASSOCIATION DOCKET

47827. **Marble spalls or crushed marble, carloads, from Knoxville, Tenn., to Black Rock, Niagara Falls, North Tonawanda and Suspension Bridge, N. Y. It is proposed to cancel the present published commodity rate on marble spalls or crushed marble, carloads, as published in Southern Ry. I. C. C. A10160, from and to the above-named points, and permit the rate of 517c per net ton, as published in Agent Glenn's I. C. C. A657 (Northbound Commodity Tariff) and Supplement 62, on the same commodity, to apply. A rate of 517c per net ton is also in effect from Concord and L. & N. R. R. quarries in the vicinity of Knoxville to these destinations.**

47875. **Phosphate rock, from Twomey, Tenn., to Siglo, Tenn. Present rate, 450c per net ton (Class "N"). Proposed rate on phosphate rock, crude, carloads, minimum weight 20 net tons, from Twomey, Tenn., to Siglo, Tenn., 254c per net ton, same as rate in effect to Columbia, Tenn.**

47948. **Crushed marble or marble chips, from New Orleans, La. (shipside), to Nashville, Tenn. It is proposed to publish the crushed stone rate of 225c per net ton, carloads, as a specific import rate on crushed marble or marble chips, from New Orleans. La. (shipside), to Nashville, Tenn.**

47976. **Ground phosphate rock** from Florida mines to Ohio and Mississippi river crossings, C. F. A. territory and eastern and interior eastern points—commodity description. It is proposed to amend commodity description published in A. C. L. R. R. I. C. C. B2363 (ground phosphate rock Trf. No. 2), from Florida mines to destinations referred to above, so as to make the present rates, now applicable only on shipments in bulk, carloads, apply on the following description: Ground phosphate rock, slush and floats (refuse and washings from phosphate rock) and soft phosphate, carloads.

48011. **Sand and gravel, crushed stone, etc.,** from Trent, Va., to Southern Ry. stations in Virginia south of Appalachia, Va. Combination rates now apply. Proposed rates on sand, gravel, crushed stone (except bituminous rock or bituminous asphalt rock), slag, rubble stone, broken stone and chert, in straight or mixed carloads (See Note 3), from Trent, Va., to Elberton and Irondale, Va., 95c; Oreton, Harvey, Jasper, Duffield, Sunbright, Glenita and Clinchport, Va., 105c per net ton. The proposed rates reflect the Docket 17517 scale for the joint line distance.

ILLINOIS FREIGHT ASSOCIATION DOCKET

5319. **Sand and gravel,** carloads (See Note 1), from Chillicothe, Ill., to Illinois Terminal R. R. stations. Rates per ton:

To (representative points)	Pres.	Prop.
Allentown, Ill.	$0.95	$0.88
Sutter, Ill.	1.01	.88
Williamsville, Ill.	1.01	.88

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

3950. **Sand, silica, washed or processed,** carload (See Note 3), from Ottawa, Millington, Oregon, Sheridan, Utica and Wedron, Ill., to Nashville, Tenn., proposed $3.82 per ton; Atlanta, Ga., proposed $4.62 per ton; present, lowest combination.

WESTERN TRUNK LINE DOCKET

7076. **Rock, crude alunite,** minimum wegiht 80,000 lb., from Marysvale, Utah, to Glassboro, Chrome and Trenton, N. J. Present—$1.01 per 100 lb. Item 329, D. & R. G. W., G. F. D. No. 6371-A, I. C. C. 314, applies only to Trenton and Chrome. Proposed—$18.80 per ton of 2000 lb.

496-P. **Limestone, agricultural,** carloads (See Note 2), from Louisville, Neb., to points on the C. G. W., Ill. Cent., C. & N. W., C. St. P. M. & O., C. M. St. P. & P. and Wabash in northern Missouri. Present — Combination. Proposed — (rate in cents per ton of 2000 lb.):

40 miles	59	150 miles	115
50 miles	63	160 miles	119
60 miles	67	170 miles	123
70 miles	71	175 miles	125
80 miles	76	180 miles	127
90 miles	82	190 miles	131
100 miles	88	200 miles	135
110 miles	96	210 miles	138
115 miles	99	220 miles	141
120 miles	102	225 miles	144
130 miles	107	230 miles	144
140 miles	111	240 miles	147
145 miles	113	250 miles	150

CENTRAL FREIGHT ASSOCIATION DOCKET

23210. To establish on **sand and gravel,** carloads, from Cannelton, Tell City, Troy and Rockport, Ind., to Lyle, Ind., rate of 90c per net ton. Present rate, 95c per net ton.

23220. To establish on **sand** (other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) or **gravel,** carloads, from North Judson, Ind., to Crown Point, Ind., rate of 70c per net ton. Present rate, 85c per net ton.

23223. To establish through rates on traffic described below from and to C. F. A. territory on mileage scale basis for the distance to and from Waynesburg, Penn., on the following commodities, viz.: sand and gravel, inbound; slag, inbound; stone (crushed, ground or burnt), inbound.

23234. To establish on **crushed stone,** carloads, from Melvin, O., to Washington C. H., O., rate of 40c per net ton. Present rate, 50c per net ton.

23241. To establish on **waste stone, viz., breakwater, chip, rip rap and spauls,** carloads (See Note 2), from Bloomington, Clear Creek, Dodgson, Quarry Jct., and Victor, Ind., to Indianapolis, Ind., rate of $1.53 per net ton. Present rate, $1.60 per net ton.

23242. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel,** carloads, from Ginger Hill and Rupel, Ind., to Millers, Ind., rate of 85c per ton. Route—Via N. Y. C., South Bend, C. S. S. & S. B. R. R. Present rate, $1 per ton intermediate Burnham, Ill.

23244. To establish on **crushed stone,** in bulk, in open cars, carloads, from Marble Cliff and Sullivant, O., to Cambridge, O., rate of $1 per net ton. Present rate, $1.10 per net ton.

23245. To establish on **sand, viz., blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica,** carloads, from Glass Rock, O., to Philo, O., rate of 80c per net ton. Route—Via N. Y. C., Zanesville, B. & O. Present rate, 13c.

23254. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica) and **gravel,** carloads, from Lake Ciecott, Ind., to Dinwiddie, Ind., rate of 95c per net ton. Present rate, classification basis of $2.80 per net ton.

TRUNK LINE ASSOCIATION DOCKET

22130. **Crushed stone,** carloads (See Note 2), from Crusher Siding, Md., to Amcelle, Md., 80c per net ton. (Present rate, $1.05 per net ton.) Reason—Proposed rate is fairly comparable with rates from Cumberland, Md., and Hyndman, Penn., to Amcelle, Md.

22158. **Crushed stone,** carloads (See Note 3), from Rock Hill, Penn., to Pittston, Penn., $1.60 per net ton. Reason—Rate comparable with rates under the Birdsboro stone scale.

22174. Amend Item 3690 of Agent Curlett's I. C. C. A-265, covering rates on **limestone, unburnt, ground or pulverized,** minimum weight 50,000 lb., from B. & O. R. R. stations to points on the Monongahela Ry., by adding Note A (with exception of Cornwall Lime Marl Co. Siding, W. V., and Salisbury, Md.), thereby making the rates on limestone, unburnt, ground or pulverized from points on B. & O. R. R. to Monongahela Ry. stations applicable on ground marl.

22180. To restrict commodity rates published in Item 850 of B. & O. Tariff I. C. C. 21064 on **sand and gravel,** carloads (See Note 3), from Cowenton, Md., to Oak St. (North Ave. Yard), (Baltimore), Md., Bear Creek Junction, Md., and Canton, Md., to apply for "B. & O. R. R. delivery only."

22185. **Glass sand,** carloads (See Note 3), from Tatesville, Penn., to Mt. Pleasant, Penn., Rochester, N. Y., Elmira, N. Y., Cumberland, Md., New York City, etc. Rates ranging from $2.10 to $3.87 per net ton. Reason—Rate comparable with rates from other shipping points.

22194. **Ground limestone,** carloads, minimum weight 50,000 lb., from Blakeslee, N. Y., to Windsor and East Windsor, N. Y., $2.03; Port Crane $1.78 and Centre Village $1.91 per net ton. Reason—Rate comparable with others from contiguous shipping points.

22207. **Limestone, ground or pulverized and limestone dust,** carloads, minimum weight in packages, 40,000 lb.; in bulk, 67,000 lb., from Pounding Mill, Va., to C. & O. destinations in Kentucky and West Virginia. Rates ranging from $1.87 to $2.32 per net ton. Reason—Rates comparable with others involving similar hauls.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

18271. **Beach or shore sand** (See Note 3), from Essex, Mass.

To	Pres.	Prop.*
Beverly, Mass.	9½	50
Boston, Mass.	11½	90
Lynn, Mass.	10½	80

Reason—To meet motor truck competition.

*Per net ton.

18294. **Sand, building, common or run of bank (See Note 2), from Avon, Conn., to Jewett City, Conn. Present rate, 5c; proposed, 4½c. Reason—To meet competition of sand pits near Jewett City, Conn., that truck sand to the job.**

Louisiana Gravel Rate Case Under Advisement

LOUISIANA'S celebrated sand and gravel case, in which the railroads are seeking to prevent the state public service commission from putting into effect the intrastate minimum scale on building materials because of the Southwest order on rates of the Interstate Commerce Commission, was under advisement recently by the special three-judge federal court, who heard the case argued.

In addition to the rate structure, the court is called to pass upon the collateral attack on the Interstate Commerce Commission ruling of June 3, which required the railroads to charge the minima rates on sand, gravel, crushed stone and shell shipments intrastate on a basis that will not be discriminatory in relation to interstate shipments.—*Shreveport* (La.) *Journal.*

The intrastate rates on sand, gravel and other materials for public works have been materially lower than the interstate rates. The Interstate Commerce Commission order came on complaint of Arkansas gravel producers, who alleged discrimination.

The Louisiana commission contended that the discrimination, if any, applied only in the northern tier of parishes and issued its order accordingly.

Ohio to New England Lime Rates Settled

RATES on lime in carloads from various producing points in Ohio to trunk-line and New England territories were found unreasonable for the future and new rates prescribed in a final report in Docket 19957, made public by the Interstate Commerce Commission October 30. Intrastate rates on lime in carloads between points within Pennsylvania were found not discriminatory against interstate commerce.

The issues involved in the case are set forth in the report, which includes several associated complaints, as follows:

"No. 19957. Complainants are the Northwestern Ohio Lime Manufacturers, a voluntary association, and its nine members, manufacturers and shippers of lime with plants at points in Ohio. By complaint filed August 1, 1927, as amended, they allege that the rates on lime, common, hydrated, quick or slacked, in carloads, from Tiffin, Martin, Gibsonburg, Marblehead, Marion, Woodville, Luckey, McVitty's, Cold Springs, Genoa and Carey, Ohio, to destinations in trunk-line and New England territories were and are unreasonable; that these rates as compared with the rates on the same commodities from points in trunk-line and New England territories to destinations in those territories were and are unduly prejudicial to complainants and unduly preferential of their competitors at points in Pennsylvania, Maryland, West Virginia and Virginia, and that the rates on these commodities from the Ohio producing points named to destinations in Pennsylvania as compared with rates to the same destinations from Pennsylvania producing points were and are unduly prejudicial to complainants and unduly preferential of competing lime manufacturers located at points in Pennsylvania. Reasonable and nonprejudicial rates for the future are sought.

"G. Corson, W. H. Corson and P. L. Corson, co-partners, trading under the firm name of G. and W. H. Corson, the New England Lime Manufacturers, a voluntary association of about 20 members, West Virginia Pulp and Paper Co., New England Lime Co., Universal Gypsum and Lime Co., American Lime and Stone Co., Merion Lime and Stone Co., Pennsylvania Lime Products Co., Van Sciver Corp., Charles Warner Co., Brockway Machine Bottle Co., J. E. Baker Co., Berney-Bond Glass Co., Whiteall Tatum Co. and Washington Building Lime Co., corporations, intervened in No. 19957. Some of these interveners introduced testimony in support of complainants' allegation of unreasonableness. Most of the interveners, however, merely opposed the allegations of undue prejudice.

"No. 19951. Complainant, the Ohio Hydrate and Supply Co., a corporation manufacturing and distributing lime, has its plant and principal office at Woodville, Ohio. By complaint filed July 25, 1927, it alleges that the rates charged on and after July 26, 1925, on shipments of burnt lime, fluxing lime or fluxing stone from Woodville to Sheffield, Wilcox, Port Allegany and Brockway, Penn., were and are unreasonable; also that the rates on the same commodities from the same point of origin to Sheffield, Wilcox and Brockway were and are in violation of the long-and-short-haul clause of section 4 of the interstate commerce act. Reasonable rates for the future and reparation are sought. The Brockway Machine Bottle Co. intervened in No. 19951 in support of complainant's allegation of unreasonableness.

"No. 20234. Complainant, Acme Glass Co., manufacturers of glass bottles and other glassware at Olean, N. Y. By complaint filed October 22, 1927, it is alleged that the rates charged on and after October 23, 1925, on shipments of fluxing lime or ground burnt lime, in carloads, from Gibsonburg to Olean were and are unreasonable. Reasonable rates for the future and reparation are sought.

"No. 20234. Sub-No. 1. Complainant, Berney-Bond Glass Co., is a corporation manufacturing glass bottles and other glassware at Clarion and Hazlehurst, Penn. By complaint filed October 22, 1927, it alleges that the rates charged on and after October 23, 1925, on fluxing lime and ground burnt lime, in carloads, from Gibsonburg to Clarion and Hazlehurst were and are unreasonable. Reasonable rates for the future and reparation are sought.

"No. 20246. Complainant, Washington Building Lime Co., a corporation manufacturing lime with principal offices at Baltimore, Md., and plants at Woodville, Engle, W. Va., and Strasburg, Va., alleges by complaint filed October 24, 1927, that the rates charged on and after October 25, 1925, on lime in carloads, from Woodville to Belair, Md., and other destinations on the Maryland and Pennsylvania, were and are unreasonable. Reasonable rates for the future and reparation are sought.

"No. 20246, Sub-No. 1. Complainant, Washington Building Lime Co., alleges by complaint filed October 24, 1927, that the rate charged on lime, in carloads, from Woodville to Catonsville, Md., has been and still is unreasonable. A reasonable rate for the future is sought."

The full text of the findings of the Interstate Commerce Commission follows:

"The rates herein found reasonable for the future will result in a general readjustment of rates to a large consuming territory which have been in effect for a number of years and apparently without serious complaint.

"In a rate adjustment consisting of large destination groups such as here considered there are usually individual rate situations which appear to be unwarranted. But when consideration is given to the adjustment as a whole, it cannot be said that such situations are indefensible.

"Under the circumstances, we do not feel that the rates here assailed were so excessive or so unreasonable under any adjustment as to justify a finding that they were unreasonable in the past. Accordingly we find:

"1. That the rates assailed were not unreasonable in the past and were not and are not unduly prejudicial.

"2. That intrastate rates maintained on lime, in carloads, between points in Pennsylvania do not result in undue or unreasonable preference of and advantage to intrastate commerce, nor in undue, unreasonable or unjust discrimination against interstate commerce.

"3. That from Gibsonburg, Woodville and other points in 78% territory here considered the present rates to points named in Appendix B following and points taking the same rates are, and for the future will be, unreasonable to the extent that they exceed or may exceed the rates shown in the last column thereof.

"4. That except as provided in the next succeeding paragraph to stations to which the present rates are made by adding differentials to the basing points shown in Appendix B following, said rates are and for the future will be unreasonable to the extent that they exceed or may exceed the rates found reasonable to the basing points by more than the present differentials.

"5. That the rates from Woodville to stations on the Maryland and Pennsylvania

railroad set forth in Appendix C following are and for the future will be unreasonable to the extent that they exceed or may exceed the rates shown in the last column thereof.

"Maintenance of the existing grouping of Woodville with Gibsonburg and other points in the 78% territory and of the present difference between the rates from that group to a given basing point, and rates from other groups in issue should be continued."

Appendix B, prescribing rates from Gibsonburg and the named points in 78% territory, on the basis of 30,000 lb. follows:

To	Cents	Cents
Rochester, N. Y.	21.5	18
Cumberland, Md.	22	18.5
Belington, W. Va.	22	18.5
Syracuse, N. Y.	22	18.5
Hagerstown, Md.	22.5	22
Utica, N. Y.	25	21.5
Strasburg, Va.	25.5	22
Baltimore, Md.	25.5	22
Albany, N. Y.	27	23.5
Philadelphia, Pa.	26.5	23
New York, N. Y.	28.5	25
Norfolk, Va.	25.5	22
Boston, Mass.	30.5	27
Rockland, Me.	30.5	27
Covington, Va.	25.5	21

Fluxing Limestone Rates

PRODUCERS of fluxing limestone in the Hillsville-Walford, Penn., district and steel companies with plants at points in Ohio, New York, Indiana, Illinois, and other states have asked the Interstate Commerce Commission to suspend Pennsylvania and Pittsburgh and Lake Erie tariffs proposing to increase the rate on fluxing stone from the Pennsylvania district to destinations in the Mahoning and Shenango valleys in Ohio from 42 to 55 cents per gross ton, effective November 11 and later days. The main ground of protest upon which the request for suspension is founded is that the increase will narrow the present spread of 63 to 50 cents per ton, as between the Marblehead, Ohio, district on the one hand and the Pennsylvania district on the other.

The Youngstown Sheet and Tube Co., Republic Iron and Steel Co. and Struthers Iron and Steel Co., the first two with plants at Youngstown, Ohio, and the latter at Struthers, Ohio, joined in a request for suspension. The Carnegie Steel Co., also with a plant at Youngstown, filed a protest by itself. Initial limestone producers protesting the increase were the Bessemer Limestone and Cement Co., Carbon Limestone Co., Union Limestone Co. and Lake Erie Limestone Co.

The protesting producers assert that the narrowing of the spread, as proposed by the railroads, would have a serious effect on them. They based that assertion on what they said was their experience in June, July and August, 1928, when, before the carriers reduced the Hillsville-Youngstown rate to 42 cents, the spread was only 50 cents instead of 71 cents, as it theretofore had been. In that period they declared that one limestone company lost all its fluxing stone business at Youngstown and adjacent points and the other producers suffered in varying degrees.

In view of the protesting stone producers the railroads are proposing the increase from 42 to 55 cents so as to remove what the producers think would be a fatal defect in their testimony in support of their thirteenth section application in respect of Ohio state rates. The protestants said that a principal witness for the carriers, in a proceeding before the Ohio commission, asserted that there should be a spread of at least 63 cents per ton between the rates from the two fluxing stone districts. When the Ohio commission reduced the Marblehead-Youngstown rate the carriers, according to the protest, "voluntarily" reduced the Hillsville-Youngstown rate to 42 cents, thereby preserving the old spread. Therefore, the protestants argue that the railroads are trying to show, in the light of the testimony about the spread, that the Ohio rate is too low because not 63 cents over the Hillsville-Youngstown rate.

The steel companies contend that the 42-cent rate is adequate. The Youngstown steel companies said that the only limit to the trainloads was the braking capacity and that about 1,000,000 tons a year were used at Youngstown, Haselton and Struthers, Ohio. —*Traffic World.*

[By a recent order entered in I. and S. docket 3379, the Commission suspended the schedules until June 11, 1930. In addition, the commission suspended the expiration date, December 31, named in the tariff establishing the 42-cent rate to the same date. Suspension of the expiration date was necessary to prevent the re-establishment of a rate higher than the 50-cent rate proposed in the suspended rate schedules.

Hearing is to be had in the case by Examiner W. A. Disque at Pittsburgh, Penn., December 6, in rooms of the Pittsburgh Chamber of Commerce.—Editor's Note.]

Rate Study Extended to Sand and Gravel

THE Interstate Commerce Commission on November 11 made public its order in Docket No. 17000, rate structure investigation, assigning that case for hearing in so far as it concerns the lawfulness of the following:

"The interstate rates and charges on sand, gravel, crushed stone, chat, and related commodities taking the same rates, in carloads, between points in Missouri and between points in Kansas, and between points in Missouri and Kansas; the interstate rates and charges on the same commodities between points in Missouri and Kansas, on the one hand, and points in Oklahoma and Arkansas, on the other hand; and the relation between said interstate rates and charges applying on the same commodities between points within the states of Missouri and Kansas, with a view to making such findings and orders in the premises and prescribing such just, reasonable and lawful rates as the facts and circumstances may appear to warrant; and that this branch of the investigation in No. 17000 be designated No. 17000—Part 11-A."

The Commission's action in broadening the scope of its general rate structure investigation, the report said, was due to a petition filed by the public service commission of Missouri with respect to the lawfulness of the interstate rates on sand, gravel, crushed stone, chat and related commodities, in carloads, between points in Missouri and points in Arkansas, Oklahoma and Kansas.

No date was set for the first hearing.

Create New Hoch-Smith Sand and Gravel, Stone Case

THE Interstate Commerce Commission has instituted a new Hoch-Smith case, to be known as No. 17000, part 11-A, rates on sand, gravel and crushed stone, from and to points in Kansas and Missouri. The creation was at the instance of the Missouri commission. It made representations to the federal body in respect to the lawfulness of rates on the commodities mentioned and related commodities between points in Missouri and points in Arkansas, Oklahoma and Kansas.

In view of those representations the commission created the new case and provided for assigning it for hearing. As to the scope of the new case, the order, other than that part saying that all railroads within the affected territory shall be made respondents and that the proceeding shall hereafter be assigned for hearing, is here given:

It is ordered, that No. 17000, rate structrue investigation, be assigned for hearing in so far as it concerns the lawfulness of (1) the interstate rates and charges on sand, gravel, crushed stone, chat, and related commodities taking the same rates, in carloads, between points in Missouri and between points in Kansas, and between points in Missouri and Kansas; (2) the interstate rates and charges on the same commodities between points in Missouri and Kansas, on the one hand, and points in Oklahoma and Arkansas on the other hand, and (3) the relation between said interstate rates and charges and the intrastate rates and charges applying on the same commodities between points within the states of Missouri and Kansas, with a view to making such findings and orders in the premises and prescribing such just, reasonable and lawful rates as the facts and circumstances may appear to warrant; and that this branch of investigation in No. 17000 be designated No. 17000—Part 11-A.

Core Drilling Bituminous Sands

CORE drilling of the bituminous sands of the McMurray area was continued during 1928 and the results incorporated into a recent bulletin of the Canada Department of Mines. A wide variation in the character of the sands indicates careful prospecting to be necessary.

Chicago Firm Has Big Contract For Russian Cement Mills

ASSOCIATED PRESS carried a news dispatch from Moscow, Russia, dated November 11, in all the big dailies, stating:

"In competition with foreign engineers, the Macdonald Engineering Co. of Chicago was successful in obtaining a $110,000,000 contract for the construction of a chain of huge cement plants, grain elevators, flour mills and miscellaneous industrial enterprises throughout the soviet union.

"The government will supply the capital, material, and labor, while the designs of the plans will be made and the work directed and supervised by a staff of 45 American engineers and steel construction experts. This will be the largest force of American engineers ever to enter Russia.

"The contract is one of the most important awarded by the soviet government since Col. Hugh L. Cooper of New York secured a contract for the supervision and erection of a great $100,000,000 hydro-electric plant on the Dnieper river.

"The Macdonald company, which was represented here by Robert P. Durham and John Chamberlain Carter, has agreed to train 15 Russian engineers in the construction of cement plants and industrial enterprises at its offices in Chicago and New York.

"Several million dollars worth of American machinery will be used in the construction and equipment of the plants to be erected by the firm.

"The contract calls for the erection of four immense cement plants of the most modern design, which will increase the present yearly Russian output of 15,000,000 to 21,000,000 bbl.

"One plant will be located at Kertch on the Black sea, where General Wrangel's anti-revolutionary troops were driven out of Russia by a Red army. Another will be at Spartak, 75 miles from Moscow; a third at Kashira, 130 miles from Moscow, and the fourth east of the Ural mountains.

"Under the terms of the contract, which runs for three years, one plant will be equipped entirely with American machinery. If this machinery proves more efficient than European machinery, American equipment will be used in the erection of the three other plants.

"The company will be paid on a cost basis plus a fixed fee that is said to be the largest ever paid by the soviet government. Payments will be made in dollars through the Chase National Bank of New York City periodically. The company will have its headquarters in Moscow, with Vice-President Carter of the Macdonald company in charge."

A statement made for Chicago Sunday newspapers, November 16, at the Macdonald company's office in Chicago, follows:

"Robert P. Durham announced that construction work on the firm's $110,000,000 contract with the Russian government will be started early next spring.

"Mr. Durham said the Macdonald company engineers will leave next month for Russia and the construction superintendents will make the trip to Russia next spring."

This announcement recalls the visit to ROCK PRODUCTS editor in November, 1928, by three commissioners, or representatives, of the Union Russian Soviet Republics headed by Sergej Preobragensky, director of silicate industries.

Seven models illustrating combinations of screen and chain feeder

An Interesting Exhibit

THE USE OF MODELS to illustrate the operation of machinery and equipment in the rock products industry has steadily grown since the establishment of manufacturers' exhibits at the conventions of the National associations of producers. ROCK PRODUCTS took an active part in helping to establish these exhibitions and was an early advocate of the use of models to make the exhibits more interesting and instructive.

It was therefore with real pleasure that an editor visited such a model exhibit at the offices of the Ross Screen and Feeder Co., 247 Park avenue, New York City. Incidentally, it is the intention of the company to exhibit this model at the annual convention of the National Crushed Stone Association in January, in which case we are sure it will be a point of great attraction. The exhibit consists of seven working models (motor-driven) of screens and feeders.

Some strikingly interesting combinations of chain and screen are shown, which will immediately cause the spectators to speculate on the possibilities of the device for solving that difficult problem of screening and cleaning muddy stone. But that is beyond our province to discuss here. We merely wish to point out that here is an exhibit of model equipment which explains a process far more eloquently and convincingly than any salesman could hope to do.

Scrapping Obsolete Equipment

WHEN machinery has outlived its usefulness and has been replaced by modern equipment, the problem of the economic removal and salvage is presented. Where such machinery is heavy and contains copper or brass fittings which have a fair scrap value, the oxy-acetylene cutting blow pipe has been found to be quite useful in facilitating the scrapping.

With the blowpipe the operator can cut the scrap into large or small pieces, regardless of whether it is iron or steel or even cast iron. The resulting junk is of a size easy to handle and quite salable as such.

The Rock Products Market

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, Farmingdale, Spring Lake and Wayside, N. J.	.48	.48	1.15	1.25	1.40	
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.25	1.15	1.75		1.75	1.75
Buffalo, N. Y.	1.00	1.05	1.05			
Erie, Penn.	.60	.85		1.30	1.30	1.30
Leeds Jct. and Scarboro, Me.			1.75		1.25	1.00
Milton, N. H.			1.75		1.25	1.00
Montoursville, Penn.	1.00	.75	.50	.40	.40	.40
Northern New Jersey	.50	.50	1.25	1.25	1.25	
South Portland, Me.		1.00	2.25			2.00
Washington, D. C.	.55	.55	1.20	1.20	1.00	1.00
Georgetown, D. C.	.55	.55	1.20	1.20	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.35	.20	.20	.40	.40	.40
Appleton, Minn.		.50	1.25		1.50	
Attica, Ind.	All sizes .75–.85					
Barton, Wis.		.40d	.50d	.65d	.65d	.65d
Des Moines, Iowa	.60	.60	1.50	1.50	1.50	1.50
Dresden, Ohio		.60– .70		.70– .80	.70– .80	
Eau Claire, Chippewa Falls, Wis.		.40	.55	.95	.85	
Elkhart Lake and Glenbeulah, Wis.	.50	.35	.50	.60	.50	.50
Grand Rapids, Mich.		.50	.60	.70	.70	.70
Hamilton, Ohio	.90-1.20	.90–1.20	.90–1.20	.90..1.20	.90–1.20	.90–1.20
Hersey, Mich.		.50		.60	.70	.70
Indianapolis, Ind.	.50– .75	.40– .60	.50– .75	.50– .75	.60– .85	.60– .85
Mankato, Minn. (b)	.55	.45	1.25	1.25	1.25	
Mason City, Iowa	.50	.50	.85	1.25	1.25	1.25
Milwaukee, Wis.	.91	.91	1.06	1.06	1.06	1.06
Minneapolis, Minn. (a)	.35	.35	1.35	1.35	1.35	1.25
St. Paul, Minn. (e)	.45	.35	.75	1.25	1.25	1.25
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Waukesha, Wis.		.45	.55	.55	.60	.60
Winona, Minn.	.40	.40	.50	1.10	1.10	1.25
SOUTHERN:						
Brewster, Fla.	.40	.40				
Charleston, W. Va.	.75	1.25	1.25	1.25	1.25	1.25
Eustis, Fla.		.50				
Ft. Worth, Texas	.75	.75	.90	1.00	1.10	1.10
Gainesville, Texas					.55	
Knoxville, Tenn.	.75–1.00	.75–1.00			1.20	1.05
Roseland, La.	.30	.30	1.00	.80	.80	.80
WESTERN:						
Los Angeles, Calif.	.10– .40	.10– .40	.20– .90	.50– .90	.50– .90	.50– .90
Oregon City, Ore.	All grades range from 1.00 to 1.50 per cu. yd.					
Phoenix, Ariz. (c)	1.25*	1.15*	1.50*	1.15*	1.15*	1.00*
Pueblo, Colo.	.80	.60		1.20		1.15
Seattle, Wash.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*

*Cubic yd. ‡Delivered on job by truck. (a) Per yd., delivered by truck, ¼-in. down, 1.25; 2-in. and less, 2.40. (b) ¼- to ¾-in., 1.25. (c) 60-70% crusher boulders. (d) Plus 15c for winter loading. (e) Prices f.o.b. cars N. P. Ry.

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; per ton f.o.b. plant.

City or shipping point	Molding, fine	Molding, coarse	Molding brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.10	2.00	2.25			4.25	
Beach City, Ohio	1.75	1.75		1.50	1.50		
Cheshire, Mass.	Sand for soap, 7.00–8.00					6.00–8.00	
Dresden, Ohio	1.50–1.75	1.25–1.50	1.50		1.50		
Eau Claire, Wis.						2.50–3.00	
Elco, Ill.	Water floated silica, 92-99½% thru 325 mesh, 18.00–40.00 per ton						
Franklin, Penn.		1.75		1.75			
Kasota, Minn.							1.00
Klondike, Mo.	2.00			2.00	2.00		
Montoursville, Penn.				1.25–1.60			
New Lexington, Ohio	1.75–2.00	1.25					
Ohlton, Ohio	1.75	1.75		2.00	1.75	1.75	
Ottawa, Ill.	1.25	1.25	1.25	1.25	1.25	3.50	3.00
Red Wing, Minn. (a)					1.50	3.00	1.50
San Francisco, Calif.[1]	3.50†	5.00†	3.50†	3.50–5.00†	3.50–5.00†	3.50–5.00†	
Silica, Mendota, Va.	Potters' flint, 8.00–14.00						

†Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (a) Filter sand. 3.00.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.50
Eau Claire, Wis.	4.30	.60–1.00
Franklin, Penn.		1.75
Ohlton, Ohio	1.75	1.75
Ottawa, Ill.	3.25	1.25
Red Wing, Minn.		1.00
San Francisco, Calif.	3.50	3.50
Silica, Va.		1.75

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. plant.

Cheshire, Mass., in carload lots	5.00–7.00
Franklin, Penn.	2.25
Klondike, Mo.	2.00
Ohlton, Ohio	2.50
Ottawa, Ill.	1.25
Red Wing, Minn.	1.50
San Francisco, Calif.	4.00–5.00
Silica and Mendota, Va.	2.50–3.00

Bank Run Sand and Gravel

Prices given are per ton, f.o.b. producing plant or nearest shipping point.

Algonquin, Ill.¶ (2-in. and less)	.30
Appleton, Minn.†	.55
Burnside, Conn.†	.75*
Des Moines, Ia.¶ (1-in. and less)	.85
Fort Worth, Tex.¶ (2-in. and less)	.60
Gainesville, Tex.¶ (1½-in. and less)	.55
Gary and Miller, Ind.†	1.15–1.40a
Grand Rapids, Mich.¶ (1-in. and less)	.50
Hamilton, Ohio¶ (1½-in. and less)	.50–1.00
Hersey, Mich.¶ (1-in. and less)	.50
Mankato, Minn.†	.70
Seattle, Wash.—Sand, 1/10-in. down, .25*; ¼-in. and less, same; gravel in sizes ranging from 2-in. and less to ½-in. and less	.25*
Winona, Minn.¶ (2-in. and less)	.60
York, Penn. Sand, ¼-in. and less, 1.00; 1/10-in. down	1.10

*Cubic yard. †Fine sand, 1/-10-in. down. (a) Cu. yd., delivered Chicago. ¶Gravel.

Current Price Quotations

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations regularly.

Portland Cement

	Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M. (1) (2)	.91¼	3.65	
Atlanta, Ga. (1) (2)		2.11	3.01¶
Baltimore, Md. (1)		2.26	3.56¶
Berkeley, Calif.		‡2.24	
Birm., Ala. (1) (2)		1.75	2.73¶
Boston, Mass.	.44½	‡1.78–1.88	3.27¶
Buffalo, N. Y.	.48¾	‡1.95–2.05	3.35¶
Butte, Mont.	.90¼	3.61	
Cedar Rapids, Ia.		2.04	2.99f
Centerville, Calif.		‡2.24	
Charleston, S. C. (2)		2.40b	3.15¶
Cheyenne, Wyo. (1) (2)	.71½	2.86	
Chicago, Ill.		1.85	3.15¶
Cincinnati, Ohio		1.72–1.92	3.22¶
Cleveland, Ohio		1.94	3.24¶
Columbus, Ohio		1.72	3.22¶
Dallas, Texas		1.80	3.39¶
Davenport, Iowa		2.04	
Dayton, Ohio		1.74	3.24¶
Denver, Colo. (1) (2)	.76¼	3.05	
Des Moines, Iowa		2.14	2.99f
Detroit, Mich.		1.95	3.25¶
Duluth, Minn.		1.84	
Fresno, Calif.		‡2.43	
Houston, Texas		1.90	3.63¶
Indianapolis, Ind.	.54¾	1.29–1.69	f2.44-3.19¶
Jack., Miss. (1) (2)		2.19	3.09¶
Jacksonville, Fla. (1) (2)		2.36	3.26¶
Jersey City, N.J.(1)		2.23	3.43¶
Kansas City, Mo.	.45½	1.82	f2.87–3.22¶
Los Angeles, Calif.	.51½	1.82	
Louisville, Ky.	.55½	1.72	f2.92–3.22¶
Memphis,T'n.(1)(2)		2.19	f2.74–3.09¶
Merced, Calif.		‡2.11	
Milwaukee, Wis.		2.00	3.30
Minneapolis, Minn.		2.02	
Montreal, Que.		1.60	
New Orleans, La.	.45½	‡1.88	3.18¶
New York, N.Y.(1)	.43¼	2.23	3.33¶
Norfolk, Va.		1.77	3.27¶
Oklahoma City, Okla.	.57¼	2.16	3.56¶
Omaha, Neb.	.54	2.01	3.49¶
Peoria, Ill.		2.02	
Pittsburgh, Pa. (1)		2.25	3.35¶
Philadelphia, Pa.(1)		2.25	3.45¶
Phoenix, Ariz.		3.51	
Portland, Ore.		2.30	
Reno, Nev. (2)		2.82	
Richmond, Va.		1.90	3.40¶
Sacramento, Calif.		‡2.35	
Salt Lake City, Utah	.70¼	2.81	
San Francisco(1)(2)		2.60	
Santa Cruz, Calif.		‡2.20	
Savannah, Ga. (2)		2.36a	3.15¶
St. Louis, Mo.	48¾	1.50–1 70	f2.65–3.00¶
St. Paul, Minn.		2.02	
Seattle, Wash.		‡2 50	f3.70
Tampa, Fla. (1) (2)		2.40	3.30¶
Toledo, Ohio		1.83–2.03	3.33¶
Topeka, Kan.	.50¼	2.01	3.41¶
Tulsa, Okla.	.53¼	2.03	3.43¶
Wheeling, W.Va. (1)		2.32	3.42
Winston-Salem, N. C.		1.84	3.34¶

Mill prices f.o.b. in carload lots, without bags, to contractors.

Albany, N. Y.		2.15	
Bellingham, Wash.		2.35†	
Buffington, Ind.		1.60	
Chattanooga, Tenn.		2.05	
Concrete, Wash.		2.25	
Davenport, Calif.		2.05	
Hannibal, Mo.		1.90	
Hudson, N. Y.		1.75	
Leeds, Ala.		1.65	
Lime & Oswego, Ore.		2.40	
Mildred, Kan.		2.35	
Nazareth, Penn.		2.15	
Northampton, Penn.		1.75	
Richard City, Tenn.		2.05	
Steelton, Minn.		1.65	
Toledo, Ohio		2.20	
Universal, Penn.		1.60	

NOTE—Add 40c per bbl. for bags. †10c disc., 10 days. ‡10c disc., 15 days. (a) With bags, 11c refund for paid freight bill. (b) With bags, 15c bbl. refund for paid freight bill. (1) Includes cloth bags at 40c. (2) 10c cash disc., 10c dealer discount. (f) "Velo" cement, including cost of paper bag, 10c disc. 10 days. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c disc. 15 days.

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chazy, N. Y.		1.60				
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Farmington, Conn.		1.30	1.10	1.00	1.00	
Ft. Spring, W. Va.	.35	1.35	1.25	1.15	1.10	1.00
Munns, N. Y.	.75	1.15	1.15	1.00	1.00	
Prospect Jct., N. Y.	.80	1.15u	1.15u	1.15u	1.10v	
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
St. Vincent de Paul, Que. (n)	.65	1.25	1.05	.95	.85	1.00
Shaw's Junction, Penn. (e)	.85	1.35–1.60	1.35	1.35	1.35	1.35
Syracuse, N. Y.	.50	1.00	1.00	1.00	1.00	1.00
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill.	1.85		1.85			
Davenport, Iowa	1.00	1.50	1.50	1.30	1.30	1.30
Dubuque, Iowa	.95	1.10	1.10	1.10	1.00	
Stolle and Falling Springs, Ill.	1.05–1.70	.95–1.70	1.15–1.70	1.05 1.70	1.05–1.70	
Greencastle, Ind.	1.25	1.10	1.10	1.10	1.00	1.00
Lannon, Wis.	.90	1.00	1.00	.90	.90	.90
McCook, Ill.	.75	.80	.80	.80	.80	.80
Sheboygan, Wis.	1.20	1.20	1.20	1.20		
Stone City, Iowa	.75		1.10	1.05	1.10	
Toronto, Canada	2.50	2.50	2.50	2.50	2.50	2.50
Waukesha, Wis.		.90	.90	.90	.90	.90
Wisconsin points	.50		1.00	.90	.90	
Youngstown, Ohio	1.00	1.00	1.25	1.25	1.25	1.25
SOUTHERN:						
Cartersville, Ga.	1.00	1.65	1.65	1.35	1.15	1.15
Chico, Texas (a)	.50	1.30	1.30	1.25	1.20	1.00
Cutler, Fla.		.50– .75r		1.50–1.75r		1.10r
El Paso, Texas (r)	.75–1.00	1.00–1.25	1.00–1.25	1.00	1.00	1.00
Olive Hill, Ky.		1.00	1.00	.90	.90	.90
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.70
Blue Springs and Wymore, Neb. (t)	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.00	1.25	1.25	1.25	1.00	
Richmond, Calif.	.75		1.00	1.00	1.00	
Rock Hill, St. Louis, Mo.	1.45	1.45	1.45	1.45	1.45	1.45
Stringtown, Okla. (a)	.50	1.30	1.30	1.25	1.20	1.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35		1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	
Chico, Texas	2.50	2.00	1.45	1.20	1.15	
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	2.00	1.45	1.25	1.20	1.00
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	
Northern New Jersey	1.35–1.40	2.00–2.10	1.80–1.90	1.40–1.50	1.40–1.50	
Richmond, Calif.	.75		1.00	1.00	1.00	
Toronto, Canada	4.70	5.80		4.05		
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Cayce, S. C.—Granite			1.75	1.75	1.60	
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.—Flint rock			2.25–2.50s			
Lithonia, Ga.—Granite	.50	1.75	1.60	1.35	1.25	
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	
Middlebrook, Mo.	3.00–3.50		2.00–2.25	2.00–2.25		1.25–3.00
Richmond, Calif.—Quartzite	.75		1.00	1.00	1.00	
Toccoa, Ga.—Granite	.50	1.50	1.50	1.25	1.25	1.20

(a) Limestone, ¼ to ⅛ in., 1.35 per ton; Lime flour, 8.50 per ton. (b) To ⅜ in. (c) 1 in., 1.40. (d) 2-in., 1.30. (e) Price net after 10c cash discount deducted. (n) Ballast R.R., .90; run of crusher, 1.00. (q) Cusher run, 1.40; ¼-in. granlithic finish, 3.00. (r) Cubic yard. (s) 1-in. and less, per cubic yard. (t) Rip rap, 1.20–1.40 per ton. (u) Less 2%, 15 days. (v) Less 2%, 10 days.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Erie and Du Bois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern New Jersey	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.00	1.00		1.00			
Western Pennsylvania	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio		1.30*		1.45*	1.45*	1.45*	
Jackson, Ohio		1.05*	1.80*	1.45*	1.05*	1.30*	
Toledo, Ohio	1.50	1.10	1.25	1.25	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.45*	1.80*	1.45*	1.45*	1.45*	
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.80
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.05
Woodward, Ala.†	2.05	.55*		1.15*	.90*	.90*	

5c per ton discount on terms. †1¼ in. to ¼ in., $1.05; ⅝ in. to 10 mesh, $1.25*; ¼ in. to 0 in., .90*; ¼ in. to 10 mesh, .80*.

Agricultural Limestone
(Pulverized)

Alton, Ill.—Analysis, 99% $CaCO_3$; .03% $MgCO_3$; 90% thru 100 mesh	2.95
Belfast, Me.—Analysis, $CaCO_3$, 90.4%; $MgCO_3$, trace, per ton	7.00
Branchton, Penn.—100% thru 20 mesh, 60% thru 100 mesh, 45% thru 200 mesh	a5.00
Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh	1.50
Cartersville, Ga.—90% thru 100 mesh, 2.00; 50% thru 50 mesh	1.50
Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, per ton	6.00
Joliet, Ill.—Analysis, 52% $CaCO_3$; 48% $MgCO_3$; 90% thru 100 mesh	3.50
Knoxville, Tenn.—Analysis, 52% $CaCO_3$; 36% $MgCO_3$; 80% thru 100 mesh, bags, 3.75; bulk	2.50
Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton	2.00
Marlbrook, Va.—Precipitated Lime) Analysis, 92% $CaCO_3$; 2% $MgCO_3$, 50% thru 50 mesh; bulk, 2.25; bags	4.50
Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh	4.25
Olive Hill, Ky.—Analysis, $CaCO_3$ 94-98%; 90% thru 4 mesh	1.00
Sibley, Mich.—Analysis, 87.47% $CaCO_3$; 8.30% $MgCO_3$; 60% thru 100 mesh, bulk, per ton, 2.30; 100-lb. paper bags, f.o.b. Sibley, Mich., per ton	3.75

(a) Less 50c comm. to dealers per ton.

Agricultural Limestone
(Crushed)

Bedford, Ind.—Analysis, 98½% $CaCO_3$; ½% $MgCO_3$; 90% thru 10 mesh	1.50
Chico and Bridgeport, Tex.—Analysis, 95% $CaCO_3$; 1.3% $MgCO_3$; 90% thru 4 mesh	1.00–1.25
Charles-Town, W. Va.—Lime Marl—Analysis, 95% $CaCO_3$, 50% thru 100 mesh, bulk, 3.00; including burlap bags	4.50
Colton, Calif.—100% thru 14 mesh, bulk	3.50
Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 4 mesh, 50% thru 20 mesh; bulk, per ton	1.10
Dubuque, Ia.—Analysis, 34.96% $CaCO_3$; 59.62% $MgCO_3$; 90% thru 4 mesh	.95
Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh	1.00
Fort Spring, W. Va.—Analysis, 40% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh, sacked	5.00
Jamesville, N. Y.—Analysis, 90% $CaCO_3$; 5% $MgCO_3$; 90% thru 100 mesh; in sacks, 4.60; bulk	3.35
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio—90% thru 100 mesh	3.00
90% thru 50 mesh	2.00
90% thru 4 mesh	1.00
McCook and Gary, Ill.—Analysis, 63% $CaCO_3$, 37% $MgCO_3$; 90% thru 4 mesh	.90
Middlepoint, Bellevue, Bloomville, Kenton and Whitehouse, Ohio; Monroe, Mich.; Bluffton, Greencastle and Kokomo, Ind.—85% thru 10 mesh, 25% thru 100 mesh	1.50
Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh	1.15–1.70
Stone City, Iowa—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
West Stockbridge, Mass.*—Analysis, 95% $CaCO_3$; 90% thru 100 mesh, bulk	3.50
100-lb. paper bags, 4.25; cloth	5.25
Waukesha, Wis.—90% thru 100 mesh, 4.00; 50% thru 100 mesh	2.10

*Less 25c cash 15 days.

Pulverized Limestone for Coal Operators

Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, per ton	6.00
Hillsville, Penn., sacks, 5.10; bulk	3.50
Joliet, Ill.—Analysis, 50% $CaCO_3$; 42% $MgCO_3$; 98% thru 100 mesh; 90% thru 200 mesh (bags extra)	3.50
bulk	4.00
Piqua, Ohio—99% thru 100 mesh, bulk, 3.50; in 80-lb. bags (f.o.b. Piqua)	5.00
Rocky Point, Va.—Analysis, 97% $CaCO_3$; 75% $MgCO_3$; 85% thru 200 mesh, bulk	2.25–3.50
Waukesha, Wis.—90% thru 100 mesh, bulk	4.00

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

EASTERN:	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
Berkeley, R. I.			12.00			17.50		2.00
Buffalo, N. Y.				12.00				
Knickerbocker, Devault, Cedar Hollow and Rambo, Penn.		9.50	9.50	9.50		9.50	8.50	
Lime Ridge, Penn.	10.00	10.00	10.00		6.00	8.00	5.00	
CENTRAL:								
Afton, Mich.						10.75	7.50	12.11
Carey, Ohio	9.50	6.50	6.50		8.00		8.00	1.50
Cold Springs, Ohio		6.50	6.50				8.00	
Gibsonburg & Whiterock, O.	9.50		6.50		8.00	10.00	8.00	
Huntington, Ind.		6.50	6.50					
Marblehead, Ohio		6.50	6.50				7.00	1.50[8]
Milltown, Ind.		7.50– 8.50		8.25– 9.25	7.00[5]	9.25[6]	6.50[7]	1.40[8]
Scioto, Ohio	10.50	7.50	7.50	8.50	8.25	.62½	7.00	1.50
Sheboygan, Wis.		10.50	10.50	10.50			9.50	2.00[4]
Tiffin, Ohio					8.00	10.00		
Wisconsin points		11.50					9.50	
Woodville, Ohio[26]	9.50	6.50	6.50	10.50[24]	7.00	9.00[9]	8.00	1.40[3]
SOUTHERN:								
Keystone, Ala.	17.00	9.00	9.00	8.00–12.00			6.00[21]	1.35
Knoxville, Tenn.		9.00	7.50	7.50			5.00[1]	1.25[2]
Ocala, Fla.		11.00						1.45
WESTERN:								
Kirtland, N. M.							15.00	
Los Angeles, Calif.							12.00	
San Francisco, Calif.	19.00	14.00–17.00	12.50	14.00–19.00	14.50[20]	.90[17]	11.00[19]	1.85[17]

[1]Also 6.00. [2]To 1.35. [3]Wooden, steel, 1.60. [4]Steel. [5]To 7.50. [6]To 9.75. [7]To 7.00. [8]To 1.50 in steel drums; 1.25 and 1.35 in waterproof bags. [9]80lb. [17]Less credit for return of empties. [19]To 14.50. [20]Also 13.00. [21]To 8.00. [24]Superfine, 99.25% thru 200 mesh. [26]General purpose hydrated lime in 10-lb. paper sacks, 12.50 per ton.

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 200 mesh (94-96% thru 300 mesh), $7.00 per ton in paper bags.

Slate Granules

Esmont, Va.—Blue, $7.50 per ton.
Pen Argyl, Penn.—Blue-black, 6.50 per ton.
Granville, N. Y.—Red, green and black, $7.50 per ton.

Roofing Slate

Prices per square—Standard thickness.

City or shipping point:	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Arvonia, Va.—Buckingham oxford grey	13.88	19.44	24.99	29.44	34.44	45.55
Bangor, Penn.—No. 1 clear	10.50–14.50	24.50	29.00	33.50	44.50	55.60
No. 1 ribbon	9.00–10.25	20.00	24.50	29.00	40.00	51.25
Sea Green No. 1	10.00–14.00	20.00	25.00	30.00	40.00	50.00
Mottled Purple	14.75–19.00	24.00	30.00	36.00	48.00	60.00
No. 1 Albion clear	9.00–10.50	16.00	23.00	27.00	37.00	46.00
Chapman Quarries, Penn.—No. 1	8.50–11.25	(Vari-tone, 12.00–13.00)				
Medium	7.75– 9.00					
Hard vein		16.00	23.00	26.00	32.00	40.00
Granville, N. Y.—Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green and gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple and unfading green	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Monson, Maine	19.80	24.00				
Pen Argyl, Penn.*						
Graduated slate (blue)		16.00	23.00	27.00	37.00	46.00
Graduated slate (grey)		18.00	25.00	29.00	39.00	48.00
Color-tone	11.50–12.50; Vari-tone, 12.00–13.00; Cathedral gray, 14.00–15.00					
No. 1 clear (smooth text)	7.25–10.50; No. 1 clear (rough text), 8.25–9.50					
Albion-Bangor medium	8.00–9.00; No. 2 clear, 8.00–9.00; No. 1 ribbon, 8.00–8.50					
Slatedale and Slatington, Penn.—						
Genuine Franklin	11.25	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1	10.50	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1 clear	9.50	18.00	22.00	26.00	36.00	46.00
Blue Mountain No. 2 clear	8.00	18.00	22.00	26.00	36.00	46.00

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.
*Unfading grey, 10.50–12.50; textural, 12.00–15.00; 10% disc. to roofer; 10%–8⅓% to wholesaler.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:	
Crude talc, per ton	5.00
Ground talc (20-50 mesh), bags	6.50
Ground talc (150-200 mesh), bags	9.00
Pencils and steel crayons, gross	1.50– 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), paper or burlap bags, bags extra	7.50– 8.50
Same, including 50-lb. Kraft paper bags	8.50– 9.50
Clifton, Va.:	
Crude talc, per ton	4.00
Ground talc (150-200 mesh), in bags	12.00
Conowingo, Md.:	
Crude talc, bulk	4.00
Ground talc (150-200 mesh), in bags	14.00
Cubes, blanks, per lb.	.10
Emeryville, N. Y.:	
Ground talc (200 mesh), bags	13.75
Ground talc (325 mesh), bags	14.75
Hailesboro, N. Y.:	
Ground talc (300-350 mesh) in 200-lb. bags	**15.50–20.00**
Henry, Va.:	
Crude (mine run)	3.50– 4.50
Ground talc (150-200 mesh), bags	8.75–14.00
Joliet, Ill.:	
Ground talc (200 mesh) in bags:	
California white	**30.00**
Southern white	**20.00**
Illinois talc	**10.00**
Crude talc	**3.75**
Los Angeles, Calif.:	
Ground talc (150-200 mesh) in bags	15.00–24.00
Natural Bridge, N. Y.:	
Ground talc (300-325 mesh), bags	**12.00–15.00**

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-68%	3.75– 4.25
Mt. Pleasant, Tenn.—B.P.L., 75%	6.50
Run of plant fines, 72% B.P.L., per ton of 2000 lb.	5.00

Ground Rock
(2000 lb.)

Gordonsburg, Tenn.—B.P.L. 65–70%	3.75– 4.50
Mt. Pleasant, Tenn.—Lime phosphate: B.P.L., 72½%	11.20
Mt. Pleasant, Tenn.—B.P.L., 72%	5.00– 5.50

Florida Phosphate

(Raw Land Pebble)
(Per Ton)

Florida—F.o.b. mines, gross ton, 68/66% B.P.L., Basis 68%	**3.25**
70% min. B.P.L., Basis 70%	**3.75**

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	100.00–125.00
Punch mica, per lb.	7c
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—Per ton,	
Mine run	300.00–360.00
Clean shop scrap	27.50–29.00
Mine scrap	22.50
Roofing mica	a37.50–40.00
Punch mica, per ton	200.00–240.00
Trimmed mica, per ton, 40 mesh, 42.50–45.00; 100 mesh, 60.00; 200 mesh	100.00
Trenton, N. J.—Mine scrap, per ton	20.00
Clean shop scrap, per ton	22.00

(a) Also 38.00–42.50 per ton.

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agri-cultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	Plaster Board ¼x32x 36". Per M Sq. Ft.	Plaster Board ⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
Acme, Tex.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Blue Rapids, Kan.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Centerville, Iowa			6.00	7.00		7.50	8.50	10.50a					
East St. Louis, Ill.—Special Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton; floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 3 in. long, 17c per ft., 23.00 per ton.													
Ft. Dodge, Iowa; N. Holston, Va.; Akron, N. Y.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Grand Rapids, Mich.			7.00d		8.00d	8.00d	19.85c	8.00d	29.25e	21.00d		15.00	22.50
Los Angeles, Calif. (b)			7.00–9.50	7.00–9.50	10.00–12.00		10.00–12.00						
Medicine Lodge, Kan.	1.40								15.00y				
Portland, Colo.		7.00	7.00	9.00	9.00	9.50	9.00		27.50		22.50	27.50	
Providence, R. I. (x)				12.00–13.00e									
Seattle, Wash. (z)	6.00	9.00	9.00	13.00			14.00						
Winnipeg, Man.	5.00		7.00	13.00	14.00	14.00					20.00w	25.00g	33.00f

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) White molding. (b) Plasterboard, ⅜-in., 16c-17c sq. yd. (c) Satin Spar, in paper bags. (d) Includes paper bags. (e) Includes jute sacks. (f) "Gyproc," ⅜ in. by 48 in. by 5 and 10 ft. long. (g) ⅜ in. by 48 in. by 3 to 4 ft. (w) 16x48. (x) "Fabricaste" gypsum blocks, 2- and 3-in., f.o.b. motor trucks at plants, 7¼c-8¼c. Block setting plaster, per ton, in jute sacks, 12.00. (y) Jute sacks, 18.00; paper sacks, 16.00. (z) Gypsum partition tile, 3-in., 9c per sq. ft.; 4-in., 11c per sq. ft.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream, and American Botticino, coral pink, pearl blush	‖12.50–‖14.50	¶12.50–‖14.50
Cranberry Creek, N. Y.—Bio-Spar, per ton in bags in carload lots, 9.00; less than carload lots, 12.00 per ton in bags; bulk, per ton		7.50
Crown Point, N. Y.—Mica Spar		¶9.00–‖12.00
Davenport, Iowa — White limestone, in bags, per ton	‖6.00	‖6.00
Easton, Penn.—Royal green	16.00–20.00a	
Harrisonburg, Va.	11.00–14.50	
Middlebrook, Mo.—Red		20.00–25.00
Middlebury, Vt. — Middlebury white		‖9.00–¶10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50
Phillipsburg, N. J.—Royal green granite		15.00–18.00
Randville, Mich.—Crystalite white marble, bulk	4.00	4.00– 7.00
Stockton, Calif.—"Nat-rock" roofing grits		12.00–20.00
Tuckahoe, N. Y.—Tuckahoe white	8.00	
Warren, N. H.		7.90– 9.50

¶C.L. ‖L.C.L. (a) Including bags. (b) In burlap bags, 2.00 per ton extra. *Per 100 lb.

Soda Feldspar

DeKalb Jct., N. Y.—Color, white; pulverized, 200 mesh, in bags, per ton, 20.00, bulk 18.00; 140 mesh, in bags, ton, 18.00; bulk	16.00

Potash Feldspar

Auburn and Topsham, Me.—Color white, 98% thru 140-mesh	19.00
Bedford Hills, N. Y.—Color, white; analysis, K_2O, 12.26%; Na_2O, 2.86%; SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; pulverized 78% thru 100 mesh, bulk, 11.00–14.00; crude, bulk, per ton	9.00
Coatesville, Penn.—Color, white; analysis, K_2O, 12.30%; Na_2O, 2.86% SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; crude, per ton	8.00
Trenton, N. J.—White; analysis, K_2O, 13-14%; Na_2O, 2-2½%; SiO_2, 64-65%; Fe_2O_3, 0.07%; Al_2O_3, 18.50-19.25%; pulverized, 97% thru 325 mesh, crude, 8.50 per ton, ground	21.00
Rumney and Cardigan, N. H.—Color, white: analysis, K_2O, 9-12%; Na_2O, trace; SiO_2, 64-67%; Al_2O_3, 17-18%, crude, bulk	7.00– 7.50
Rumney Depot, N. H.—Color, white; analysis, K_2O, 8-13%; Na_2O, 1-1½%; SiO_2, 62-68%; Al_2O_3, 17-18%, crude, bulk	7.00– 7.50
Penland, N. C.—White; crude, bulk	8.00
Ground, bulk	16.50
Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; pulverized, bulk	18.00

(Bags 15c extra.)

Chicken Grits

Centerville, Iowa	9.25
Belfast, Me.—(Agstone), per ton, in carloads	10.00
Chico, Tex.—Hen size and Baby Chick, packed in 100-lb. sacks, per ton	10.00
Coatesville, Penn.—(Feldspar), per ton, in bags of 100 lb. each	8.00
Cranberry Creek, N. Y.—Per ton, in carload lots; in bags, 9.00; bulk, 7.50. Less than carload lots, in bags	12.00
Davenport, Iowa — High calcium carbonate limestone, in bags L.C.L., per ton	6.00

Los Angeles, Calif.—Per ton, including sacks:	
Gypsum	7.50– 9.50
Middlebury, Vt.—Per ton (a)	10.00
Randville, Mich.—(Marble), bulk	6.00
Seattle, Wash.—(Gypsum), bulk, ton	10.00
Warren, N. H.	8.50– 9.50
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.	7.50– 9.00
Wisconsin Points—(Limestone), per ton	15.00

(a) F.o.b. Middlebury, Vt.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Dayton, Ohio	12.50–13.50
Detroit, Mich. (d)	e13.00–16.00*b
Farmington, Conn.	16.00
Grand Rapids, Mich.*	14.00–15.00
Jackson, Mich.	13.00
Lake Helen, Fla.	8.50– 9.00
Madison, Wis.	12.50a
Mishawaka, Ind.	11.00
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	10.00*
New Brighton, Minn.	10.00
Pontiac, Mich.	13.50
Portage, Wis.	15.00
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	12.50
Sebewaing, Mich.	12.50
South St. Paul, Minn.	9.00
Syracuse, N. Y.	18.00–20.00
Toronto, Canada (f)	g12.50–15.00c
Winnipeg, Canada	15.00

Delivered on job. (a) Less 50c disc. per M 10th of month. (b) 5% disc., 10th of month. (c) Delivered in city. (d) Also 15.50. (e) Also 14.00. (f) Also 14.00, f.o.b. city jobs. (g) F.o.b. yard.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

City or shipping point	Size 8x8x16
Camden, N. J.	16.50
Chicago District	180.00–210.00a
8x10x16	230.00–260.00a
8x12x16	280.00–330.00a
Columbus, Ohio	13.00b– 15.00†
Forest Park, Ill.	21.00*
Grand Rapids, Mich.	11.00*
Graettinger, Iowa	.18– .20
Indianapolis, Ind.	.10– .12a
Los Angeles, Calif.:	
4x8x12	4.50*
4x6x12	3.90*
4x4x12	2.90*

*Price per 100 at plant.
†Rock or panel face.
(a) Face. (b) Plain.

Cement Building Tile

Camden and Trenton, N. J.:	
3x8x16, per 100, 9.00; 3x9x16, per 100	9.00
4x8x16, per 100, 12.00; 4x9x16, per 100	13.00
6x8x16, per 100, 16.50; 6x9x16, per 100	15.50
Chicago District (Haydite):	
4x 8x16, per 100	13.00
8x 8x16, per 100	20.00
8x12x16, per 100	28.00
Columbus, Ohio:	
5x8x12, per 100	6.00
Grand Rapids, Mich.:	
5x8x12, per 100	6.00
Houston, Texas:	
5x8x12 (Lightweight), per M	80.00
Longview, Wash.:	
4x6x12, per 1000	55.00
4x8x12, per 1000	64.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Camden & Trenton, N. J.	17.00	
Chicago District "Haydite"	14.00	
Columbus, Ohio	16.00	17.00
Ensley, Ala. ("Slagtex")	13.00a	
Forest Park, Ill.		37.00

Longview, Wash.	16.50	20.00– 40.00
Milwaukee, Wis.	14.00	31.50
Omaha, Neb.	17.00	30.00– 40.00
Philadelphia, Penn.	15.50	
Portland, Ore.	12.00	22.50– 55.00
Prairie du Chien, Wis.	14.00	22.00– 25.00
Rapid City, S. D.	18.00	30.00– 40.00

(a) Delivered on job; 10.00 f.o.b. plant.

Cement Drain Tile

Graettinger, Iowa.—Drain tile, per foot: 5-in., .04½; 6-in., .05¼; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in., .35; 18-in., .50; 20-in., .60; 24-in., 1.00; 30-in., 1.35; 36-in.	2.00
Longview, Wash.—Drain tile, per 100 ft.	
3-in.	5.00
4-in.	6.00
6-in.	10.00
Tacoma, Wash.—Drain tile, per 100 ft.	
3-in.	4.00
4-in.	5.00
6-in.	7.50
8-in.	10.00

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.:	
Red	15.00
Green	18.00
Cicero, Ill.—French and Spanish tile (red, orange, choc., yellow, tan, slate, gray) per sq., 9.50–10.00; green or blue, per sq.	11.50–12.00
Detroit, Mich.—5x8x12, per M	67.50
Houston, Texas—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00

Note—Bags extra and returnable for full credit.

Stone-Tile Hollow Brick

Prices are net per thousand f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Asheville, N. C.	35.00	50.00	60.00
Atlanta, Ga.	29.00	42.50	53.00
Brownsville, Tex.	......	53.00	62.50
Brunswick, Me.†	40.00	60.00	80.00
Charlotte, N. C.	35.00	45.00	60.00
De Land, Fla.	30.00	50.00	60.00
Farmingdale, N. Y.	37.50	50.00	60.00
Houston, Tex.	35.00	45.00	60.00
Jackson, Miss.	45.00	55.00	65.00
Klamath Falls, Ore.	65.00	75.00	85.00
Longview, Wash.	......	55.00	64.00
Los Angeles, Calif.	29.00	39.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	50.00	55.00	65.00
Mineola, N. Y.	45.00	50.00	60.00
Nashville, Tenn.	30.00	49.00	57.00
New Orleans, La.	35.00	45.00	60.00
Norfolk, Va.	35.00	50.00	65.00
Passaic, N. J.	35.00	50.00	65.00
Patchogue, N. Y.	......	60.00	70.00
Pawtucket, R. I.	35.00	55.00	75.00
Safford, Ariz.	32.50	48.75	65.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% disc.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8-in.	10 in.	12 in.	15-in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Grand Rapids, Mich.(b)	......	......	......	.60	.76	.90	1.20	......	......	1.80	2.10	2.35	3.50	4.00	5.60	6.90	7.85
Houston, Texas	......	.19	.28	.43	.55½	.90	1.30	......	1.70†	2.20	......	......	......	......	......	......	......
Indianapolis, Ind. (a)	......	......	......	.75	.85	.90	1.15	......	......	1.60	......	2.50	......	......	......	......	......
Norfolk, Neb. (b)	......	......	......	.90	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Tiskilwa, Ill. (rein.)	......	......	......	.75	.85	.95	1.20	1.60	......	2.00	......	2.75	3.40	......	6.50	......	10.00
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	......	......	......	......	......	......	......	......	......	......
Wahoo, Neb. (b)	......	......	......	......	.85½	......	1.14	......	......	1.81	......	2.47	3.42	4.13	5.63	6.49	7.31

(a) 24-in. lengths. (b) Reinforced. †21-in. diameter.

Another Good Reason for Not Fixing Prices

DEDUCTION from gross income of amounts paid by a taxpayer on account of fines imposed by a state court, and court costs and attorney's fees in connection therewith, have been disallowed by the U. S. Board of Tax Appeals because the board held them not to be ordinary and necessary business expense. Since the fines resulted from violation of law, the board held that they could not be considered as necessary incidents of the conduct of business.

This decision was made in the case of the Burroughs Building Material Co., Brooklyn, N. Y., a building supply dealer. This company in 1920 was a member of an association of building material dealers, the members of which were found guilty in New York state courts of price-fixing. Fines, attorney's fees, etc., amounted to $7510, which the company attempted to deduct from its income as a necessary expense of doing business.

Sales of Barite and Barium Products in 1928

IN 1928 the barium industry in the United States reached new high peaks, as evidenced by the increased sales of crude barite, barium products (ground barite and lithopone) and barium chemicals. Total sales of crude barite were 269,544 short tons, valued at $1,754,924, according to reports made by producers to the United States Bureau of Mines, Department of Commerce. The quantity sold was the highest recorded in the last 10 years. Sales of crude barite were made from eight states—California, Colorado, Georgia, Missouri, South Carolina, Tennessee, Virginia and Wisconsin, and of these only three showed decreases as compared with 1927—South Carolina, Tennessee and Virginia. Colorado produced a small quantity of barite for the first time since 1916. Quotations for crude barite during the year were lower than those for 1927, dropping from $8 a short ton in 1927 to $6.50 to $7.50 a ton in 1928.

A noticeable feature of the crude barite industry in 1928 was the continued parallel growth in Georgia and Missouri. In the last five years sales in Georgia have increased from 71,776 tons in 1924 to 112,316 tons in 1928, and in Missouri from 77,189 short tons in 1924 to 114,274 tons in 1928.

Of the crude barite, both domestic and foreign, consumed in the manufacture of barium products, 63% was used in lithopone, 22% in ground barite and 15% in barium chemicals.

Foreign crude barite imported for consumption in this country in 1928 amounted to 61,765 short tons, valued at $190,756.

Totals for the barium products (ground barite and lithopone) and barium chemicals also showed increases over 1927. Combined sales of the barium products and chemicals amounted to 295,863 short tons, valued at $22,275,707. As compared with 1927 sales of ground barite increased 12% in quantity, sales of lithopone increased 13% and sales of barium chemicals increased 27%.

CRUDE BARITE SOLD BY PRODUCERS IN THE UNITED STATES, 1927-28

	1927			1928		
		Value			Value	
State	Short tons	Total	Per ton	Short tons	Total	Per ton
California	13,919	$ 71,708	$5.15	12,557	$ 51,502	$4.10
Georgia	94,039	580,300	6.17	112,316	675,509	6.01
Missouri	111,456	797,465	7.15	114,274	810,203	7.09
Nevada	884	3,969	4.49	....	....	......
Tennessee	20,537	129,999	6.33	20,260	150,937	7.45
Other states*	13,430	87,437	6.51	10,137	66,773	6.59
	254,265	$1,670,878	$6.57	269,544	$1,754,924	$6.51

* 1927: South Carolina, Virginia and Wisconsin; 1928: Colorado, South Carolina, Virginia and Wisconsin.

BARIUM PRODUCTS SOLD BY PRODUCERS IN THE UNITED STATES, 1927-28

	1927			1928		
		Value			Value	
Product	Short tons	Total	Per ton	Short tons	Total	Per ton
Ground barite	57,658	$ 1,166,294	$20.23	64,425	$ 1,332,228	$20.68
Lithopone	176,994	17,163,620	96.97	200,468	19,073,914	95.15
Barium chemicals*	23,943	1,517,994	....	30,970	1,869,565	....
	258,595	$19,847,908	....	295,863	$22,275,707	....

*Barium chemicals manufactured from barium products bought in open market are not included in table in order to avoid duplication; the total output of barium chemicals is therefore not shown above. 1927: Binoxide, hydroxide and sulphide; 1928, Binoxide, hydroxide, sulphate and sulphide.

Recent Contract Prices

Delaware County, Iowa. County farm bureau contracted for agricultural limestone, carloads, with the Dubuque Stone Products Co., Dubuque, Iowa, at a price of $1.73 per ton delivered at Manchester, Iowa, less a cash discount of 5 cents per ton for cash in 10 days. Other cars dumped along right-of-way at various prices. Eleven cars received along Great Western from Farley to Oneida at average price of $1.60 per ton. —*Waterloo* (Iowa) *Courier.*

Retail Prices of Various Rock Products Materials

THE TABLE below gives average prices paid October 1, 1929, by contractors for various rock products, delivered on the job at different principal cities of the United States. These prices were secured through the Bureau of Census.

AVERAGE RETAIL PRICES FOR ROCK PRODUCTS MATERIALS, OCTOBER 1, 1929

	MATERIAL					
City	Portland cement, per bbl. excl. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$3.10	....	$21.50	$1.50	$2.25	....
Waterbury, Conn.	3.00	30.00	20.00	1.35	2.45	$20.00
New London, Conn.	3.00	25.00	26.00	1.50	3.00	18.00
New Bedford, Mass.	2.80	25.00	18.00	1.75	3.00	18.50
Haverhill, Mass.	2.80	27.50	20.00	1.75	......	15.00
Poughkeepsie, N. Y.	2.28	22.00	24.00	2.50	3.50	18.00
Albany, N. Y.	2.97	24.75	18.00	......	......	15.30
Syracuse, N. Y.	3.00	22.50	24.00	2.35	1.80	18.00
Rochester, N. Y.	2.70	20.00	......	2.50	2.40	14.00
Buffalo, N. Y.	3.10	25.00	18.00	2.50	2.05	14.00
Paterson, N. J.	2.40	23.00	20.00	1.75	2.08	17.00
Trenton, N. J.	2.40	26.00	18.00	1.50	2.10	17.50
Scranton, Penn.	2.80	....	18.00	3.25	......	....
Philadelphia, Penn.	2.05	....	15.50	1.85	2.45	19.75
Harrisburg, Penn.	2.25	....	19.00	4.20	1.60	20.50
Baltimore, Md.	2.40	....	13.00	2.00	2.75	15.00
Washington, D. C.	2.55	25.00	14.00	......	......	....
Richmond, Va.	3.10	31.00	17.50	1.95	2.45	20.00
Fairmount, W. Va.	2.90	35.00	17.00	3.25	3.40	18.00
Winston-Salem, N. C.	2.34	23.50	14.00	2.50	4.50	15.00
Louisville, Ky.	......	23.50	15.50	2.20	2.43	16.00
Shreveport, La.	3.20	....	22.50	2.00	4.75	24.00
Tampa, Fla.	2.40	....	20.00	2.00	4.00	19.00
Birmingham, Ala.	2.40	....	20.00	3.00	......	16.00
Erie, Penn.	2.80	25.00	17.00	2.25	......	16.00
Canton, Ohio	$2.50	$33.00	$16.00	$2.50	$3.50	$15.00
Toledo, Ohio	......	22.50	20.00	3.04	2.50	16.00
Columbus, Ohio	2.75	23.00	17.50	2.25	2.50	15.00
Cleveland, Ohio	2.56	22.00	16.00	2.57	2.65	....
Youngstown, Ohio	2.80	....	18.00	2.75	2.75	15.00
Detroit, Mich.	2.60	24.60	14.80	2.75	3.00	18.00
Saginaw, Mich.	2.80	25.00	20.00	2.80	3.00	20.00
Terre Haute, Ind.	2.75	28.00	18.00	1.65	3.50	17.00
Rockford, Ill.	2.40	25.00	18.00	1.75	2.25	15.50
Chicago, Ill.	1.80	....	16.50	1.63	1.90	14.33
Milwaukee, Wis.	2.40	25.00	....	1.90	1.55	18.00
Lansing, Mich.	2.90	....	20.00	2.25	2.25	16.00
Des Moines, Iowa	2.66	23.75	20.00	•1.60	3.60	....
St. Louis, Mo.	2.20	....	18.00	2.70	1.90	16.00
Kansas City, Mo.	2.40	25.00	24.00	1.70	1.87	18.00
St. Paul, Minn.	2.60	25.00	21.00	1.40	2.00	16.00
Sioux City, Iowa	2.80	27.00	26.00	1.50	2.25	16.00
Grand Forks, N. D.	2.80	25.00	....	2.60	......	16.00
San Antonio, Tex.	2.82	37.00	20.00	2.10	2.35	18.90
Tucson, Ariz.	......	....	30.00	1.25	2.50	15.00
Los Angeles, Calif.	2.20	34.00	24.00	2.30	2.05	17.50
Long Beach, Calif.	2.46	....	26.00	2.16	2.30	14.10
San Francisco, Calif.	2.60	....	25.50	1.40	1.25	20.00
Seattle, Wash.	2.65	32.50	22.00	1.50	......	20.00

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Manufacture of Art Objects of Colored Cement

Part II—Majolica Tile for Use as Inserts in Metal Structures

By George Rice
Palo Alto, Calif.

CEMENT Majolica tile, beautified with glazed colors, make attractive and artistic inserts for objects constructed of metal. This type of tile, which derives its name from the island of Majolica, Italy, where highly glazed and intrically designed tile has been made for hundreds of years, is

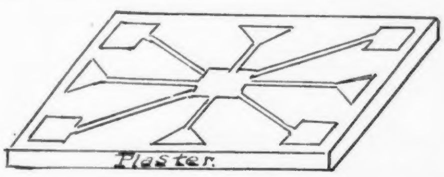


Fig. 1. Outline of design is traced on the plaster surface and a cement cast made from it

made by first tracing the proposed design in outline on a plaster cast and then incising it, as shown in Fig. 1. To make this case, use a molding plaster (plaster of paris) mix made of two parts plaster to one of water. This ought to make it near the consistency of molasses and sufficiently pliable and soft to handle even after it has been poured and allowed to stand a short time. The pouring is done into a mold made similar to a mold used for casting cement objects. Retaining bars can be set up in a square formation on a glass or other smooth surface, the proper size and shape for the intended casting, and held in place with

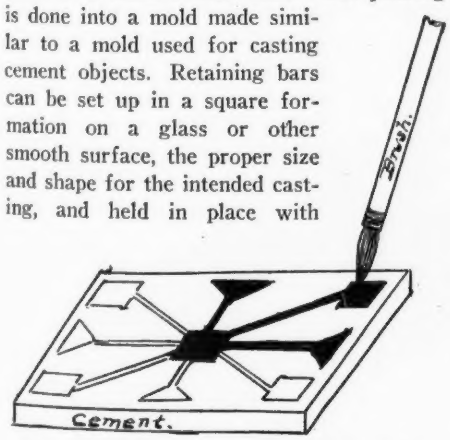


Fig. 2. Cells made by relief lines are dripped with color

putty or nails. Let the plaster set for an hour and then remove it from the mold and place it on a level surface for the incising process.

The incising can be done with almost any sharp pointed wood or metal instrument, for it consists mainly in cutting lines in the plaster. As the latter is still soft this can be done readily. The cast in Fig. 1 shows the plaster model with the design incised into its surface. The incisions can consist of hair-lines or broad open spaces.

Geometrical forms can be made, or floral shapes, or figures from animal life. We have seen excellent landscapes carved into the plaster molds by someone who is handy with the incising tool.

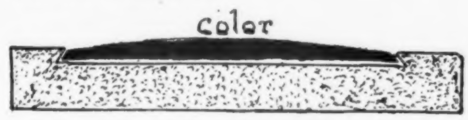


Fig. 3. Color is fitted into slightly tapered cell lines and locked in when hard

The next thing is to make a cast from this plaster mold, which is done by using the retaining bars again, placing them about this plaster mold and holding them securely in position with putty or clay. This first plaster cast now becomes the mold for the cement tile.

It is brushed over with grease together with the inner sides of the retaining bars and then the prepared cement is poured in upon it to the proper depth to make a tile. As the lines of the design on the original plaster mold were incised the corresponding lines will come out in relief in the cement casting. But if the design on the cement tile is desired to be like that on the plaster mold, and incised into it instead of in relief, then the second or cement casting simply becomes the mold for another cast.

If the cement tiles are cast direct from the plaster mold, then there will be considerable surface area between the relief lines to be filled in with color cement, or concrete enamel color, as some call it. But if they are cast from the mold which has been made from the plaster mold, then the incised design will be like that in the plaster mold and the cells made by these lines are themselves dripped with the color as shown in Fig. 2. In order to make this color cement lock into place securely it is bevelled a little in the center, as shown in section in Fig. 3. The tendency is for the color, after it sets and hardens, to fit snug when it is thus bevelled.

(To be continued)

Delco Company Builds Modern Products Plant at Chester, Penn.

CONTINUING its expansion since organization in 1923, the Delco Concrete Products Co. has just completed a new and modern products plant at Chester, Penn. The plant has facilities for producing 4000 concrete blocks and 10,000 bricks daily. Twenty workmen are employed.

The Delco company delivers its product, which has come into general use for all types of buildings, within a radius of 25 miles.

The new factory is of concrete block and steel construction, four stories in height, and served by a railroad siding for delivery of cement and sand and which connects to the main line of a railroad over which finished block are shipped. Raw material storage of 165 tons has been provided. Recent types of concrete batching and mixing machinery have been installed as well as large steam-curing chambers.

George R. Cosgrove is president of the Delco company.—*Chester* (Penn.) *Times.*

Limestone Screenings Improve Concrete Products

By L. C. Hill

AUTHORITIES agree that the fineness modulus of an ideal sand or fine aggregate should be around 3.00, but there is a wide difference in opinion regarding the percentage of the aggregate, if any at all, that should pass the 100-mesh sieve.

The bulk of the sand on the market is a washed product and naturally that very fine portion which ordinarily would pass the 100-mesh is washed out, probably the average percentage to pass the 100-mesh will not exceed 1%. It is claimed by some authorities that this fine material (that passing the 100-mesh sieve) causes crazing and excess shrinkage on setting. However, the author is in hopes that the Portland Cement Association will some day prove, probably by means of slow-motion pictures, that crazing is caused by what might be termed a structural condition that exists during the setting process of the concrete.

Limestone Lowers Absorption and Increases Strength of Block

Through several years of experimenting while the author was connected with the Jacksonville Concrete Products Co., Inc., of Jacksonville, Fla., he found that the pulverized limestone which was used in the manufacture of artificial stone, had a peculiar effect in the block and tile mixes. It was found by a series of tests that substituting limestone for a portion of the sand lowered the absorption and increased the compressive strength. Between 5 and 10% of this limestone passed the 100-mesh sieve and undoubtedly this fine material united with the cement to form an abundance of paste which thoroughly coated each and every particle of the aggregate which in turn had a sort of a lubricating effect on the mix, producing a denser concrete having a higher compressive strength.

The above statement is verified in the Portland Cement Association booklet on "The Manufacture of Concrete Masonry Units," on page 4, which reads as follows: "In a recent series of tests on tamped concrete block, two varieties of fine aggregate containing relatively large percentages of dust finer than the 100-mesh sieve gave unexpectedly high strengths. Apparently a certain portion of very fine materials results in greater workability and increased strength."

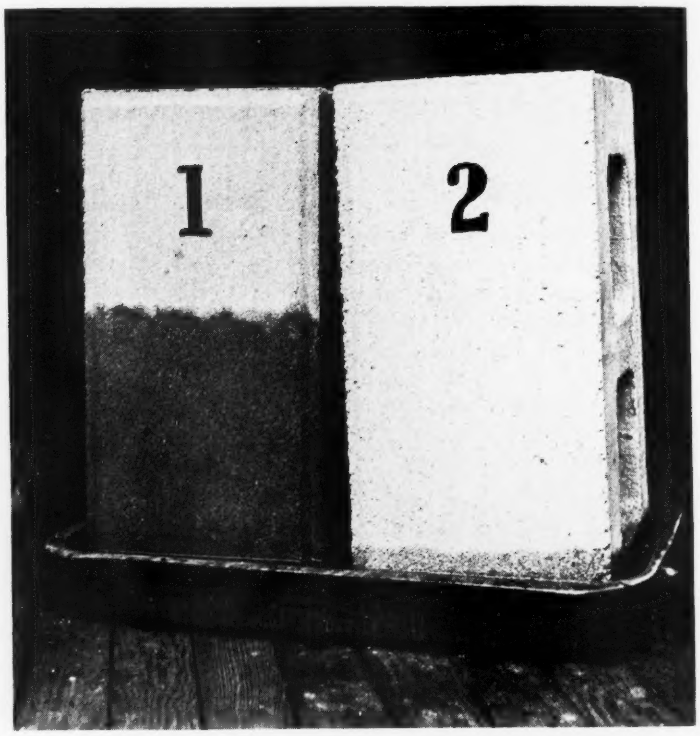


Fig. 1. Comparative absorption of all-sand concrete block (1) and sand-limestone concrete block (2)

Keen competition and building code requirements make it necessary to concentrate on the design of the mixes and secure the utmost in quality with a minimum of cost per batch. The question of mixing water is just as important in products work as it is in poured work; the tendency has always been to use too dry a mix, especially in making building units. It is an absolute fact that an increase of the compressive strength can be obtained by using the maximum of mixing water. The more mixing water you can get into the batch, up to the point where the units will slump on being removed from the machines, the higher the compressive strength.

A very simple yet reliable comparative absorption test can be made as shown in Fig. 1. The No. 1 block is an all sand block of a 1:6 mix, the No. 2 block was made up of 37½% of the sand replaced with pulverized limestone. About an inch of water

SOUTHERN TESTING LABORATORIES
Birmingham, Alabama
Report of Tests on Sample of Clay Tile and Concrete Block.
Laboratory Nos. J-5336 to 5344, inclusive.
Received May 9, 1928. Reported May 11, 1928.
Identification marks: See below.
Submitted by Jacksonville Concrete Products Co.
Reported to Jacksonville Concrete Products Co., Jacksonville, Fla.
Specifications governing: American Concrete Institute.

Lab. No.	Marks	Size	Area sq. in.	Weight lb.	Load, lb.	Load lb./in.²	Absorption
J-5336	6-cell	8x12x12	96	35	27,860	290	20.7%
J-5337	6-cell	8x12x12	96	37.5	27,220	284	
J-5338	6-cell	8x12x12	96	36	38,260	399	
						Average, 324	
J-5339	H	7 9/16x12x10⅛	90.75	......	71,200	785	9.0%
J-5340	H	7 9/16x12x10⅛	90.75	......	70,300	775	
J-5341	H	7 9/16x12x10⅛	90.75	......	61,620	679	
						Average, 746	
J-5342	Concrete	8x16x7½	128	......	146,600	1145	6.5%
J-5343	Concrete	8x16x7¾	128	......	187,040	1461	
J-5344	Concrete	8x16x7½	128	......	†200,000	†1562*	
						Average, 1389+	

*Capacity of machine, 200,000 lb. †Above.

SOUTHERN TESTING LABORATORIES
Birmingham, Alabama
Report of Tests on Sample of Concrete Building Tile.
Laboratory Nos. J-6934–6939. Received September 24, 1929. Reported September 28, 1929. Sampled September 24, 1929. Weight of sample, 50 lb.
Identification marks: Three marked "sand," three marked "limestone."
Made from special batches. Submitted by L. C. Hill, Jacksonville, Fla.
Reported to Nathan C. Rockwood, Editor, ROCK PRODUCTS, Chicago, Ill.
Specifications governing: American Concrete Institute.

NOTE—White sand from Diamond Sand Co., Interlachen, Fla. Gravel, ⅜-in., from Montgomery, Ala. Limestone from Brooksville, Fla. Cement, "Atlas" brand portland. Exactly 9 qt. water used to each bath. Moisture in sand and limestone not included.

Mark	Size, in.	Area sq. in.	Load, lb.	Load lb./in.²
Sand aggregate	7⅞x7⅞x15¾	123.95	132,600	1,069
Sand aggregate	7⅞x7⅞x15¾	123.95	138,180	1,114
Sand aggregate	7⅞x7⅞x15¾	123.95	127,080	1,025
				Average, 1,069
Limestone aggregate	7⅞x7⅞x15¾	123.95	144,440	1,164
Limestone aggregate	7⅞x7⅞x15¾	123.95	131,200	1,058
Limestone aggregate	7⅞x7⅞x15¾	123.95	150,460	1,213
				Average, 1,145

Absorption: Sand aggregate tile, 6.92%; limestone aggregate tile, 5.41%.

is placed in the pan and the blocks stood on end; the result can be plainly seen. The rough appearance of the No. 2 block is due to the "web" marks produced my having an abundance of paste.

The absorption qualities of concrete units are a very important point in sales talks. Herein is a reproduction of a test sheet showing the direct comparison between two different types of terra cotta tile and a concrete block, giving the average compressive strength and absorption of each. Comparative tests on competitive products as well as on brick and terra cotta tile are great helps in sales work.

There is given the results of a direct comparative test which was made exclusively for this article to show the benefit of a small portion of limestone in a fairly well designed mix of sand and gravel. The type unit used was the same as shown in Fig. 1, being a two-cell 8x8x16-in. unit. The area of 123.95 sq. in. as shown is the gross area, the net area being around 84 sq. in.

It might be well to state at this point that an ideal products mix should have a fineness modulus of between 3.75 and 4.25 and have at least 25% retained on the No. 4 sieve. The mix can be checked from time to time during the day by catching a quart cup of the mix as it comes to the machines and screening it in a bucket of water.

The screen analyses of the separate aggregate and the combined mixes are as below. While a number of different grades of limestone were available, this particular one was selected on account of having a minimum of fines, only 5% passing the 100-mesh sieve.

The effect of the limestone is more noticeable in leaner mixes and this ought to convince the most skeptical that even a good mix can be improved by the addition of limestone although it does not contain a large amount of fine material.

SCREEN ANALYSIS OF AGGREGATES FOR TEST BLOCKS

	Gravel			Fine Limestone			Sand	
Screen	% on		Screen	% on		Screen	% on	
¾	0	.00	¾	0	.00	¾	0	.00
⅜	14	.14	⅜	0	.00	⅜	0	.00
4	79	.93	4	1	.01	4	0	.00
8	6	.99	8	19	.20	8	1	.01
14	1	**1.00**	14	22	.44	14	12	.13
28	0	1.00	28	25	.69	28	31	.44
48	0	1.00	48	20	.89	48	35	.79
100	0	1.00	100	8	.97	100	20	.99
			Thru 100	5	......	Thru 100	1	......
	100%	6.06 F.M.		100%	3.20 F.M.		100%	2.36 F.M.

COMBINED "A" MIX
(Sand and Gravel)

Screen	% on	
¾	0	.00
⅜	6	.06
4	27	.33
8	3	.36
14	8	.44
28	23	.67
48	24	.91
100	8.66	.9966
Thru 100	0.34	....
	100.00%	3.7666 F.M.

COMBINED "B" MIX
(Sand, Limestone and Gravel)

Screen	% on	
¾	0	.00
⅜	5	.05
4	31	.36
8	7.5	.435
14	11	.545
28	18	.725
48	14	.865
100	11	.975
Thru 100	2.5	......
	100.0%	3.955 F.M.

UNIT WEIGHTS OF LOOSE AND DAMP MATERIAL

(1) Bkt. sand	35 lb.
(1) Bkt. limestone	30 lb.
(1) Bkt. gravel	37½ lb.

(U. S. Standard 12-qt. bkt.)

MIX "A"
(Sand and Gravel)

Parts by vol. Loose & damp	Ingredient	Parts by vol. Dry rodded		Loose & damp Weight
(1) Bkt.	Cement	1.00	(Dry)	31 lb.
(5) Bkt.	Sand	3.75		175 lb.
(2) Bkt.	Gravel	2.00		75 lb.
(8) Bkt.		6.75		281 lb.

MIX "B"
(Sand, Limestone and Gravel)

Parts by vol. Loose & damp	Ingredient	Parts by vol. Dry rodded		Loose & damp Weight
(1) Bkt.	Cement	1.00	(Dry)	31 lb.
(3) Bkt.	Sand	2.25		105 lb.
(2) Bkt.	Limestone	1.50		60 lb.
(2) Bkt.	Gravel	2.00		75 lb.
(8) Bkt.		6.75		271 lb.

NOTE: Exactly 9 qt. of water used in each batch, moisture in aggregates not included.

Manufacturers of pre-cast tanks, vats, septic tanks, sewer pipe, etc., having to withstand hydrostatic tests will find the addition of limestone very beneficial. It is also the author's opinion that it is only a question of time until nearly all architects and engineers will specify a portion of limestone in all mixes used for reinforced work, especially for basement walls, swimming pools, etc.

Marbray Company Producing Artificial Marble

THE Marbray Manufacturing Co., Spokane, Wash., is now manufacturing a marble-like composition called "Marbray," adapted to various uses. The product strongly resembling marble is a composition which in a semi-liquid consistency is poured into moulds, where it hardens to a form resembling marble but weighing somewhat less. The color and linings of marble are faithfully reproduced in Marbray by the addition of coloring matter to the paste as it is mixed. As in marble, the colors follow through the entire block. Marbray as it comes from the moulds has a smooth and lustrous finish and, unlike the stone it imitates, requires no polishing or buffing. It has already been used extensively in show windows of leading department stores.

Among those interested in the company is E. E. Butler, engineer, the inventor, J. C. Cone and E. A. Duffold, all of Spokane.

Concrete Pipe Factory to Open at Houston

CONSTRUCTION will be started immediately on a $40,000 plant at Houston, Texas, for the Houston Concrete Pipe Co., incorporated recently with a capitalization of $29,000 by S. H. Walker, C. L. Kerr and E. M. Bishop.

This enterprise is the third concrete pipe manufacturing concern in Houston and will furnish employment for about 15 men, according to Mr. Walker, the president and organizer of the company. The firm will specialize in machine-made concrete pipe, and will have an output of 50 tons per day, including all sizes.

An independent testing laboratory has been completed by the company to test and certify to the quality of the entire output of the new factory.

S. H. Walker was connected with the Gulf Concrete Pipe Co. as assistant manager for several years. C. L. Kerr is president of the Micolithic Co. of Texas and is district sales manager for the Gulf Refining Co. E. M. Bishop is local manager for the A. C. Horn Co. of Texas.—*Houston* (Tex.) *Pilot.*

Land-Markers of Concrete

THERE have been many novel cement products made in recent times, and the illustration is a fair representative. It is a land-marker, designed and made by George Hawkins, a prosperous farmer near St. Charles, Ill. Wherever his land corners with that of somebody else, he has set up one of these concrete markers.

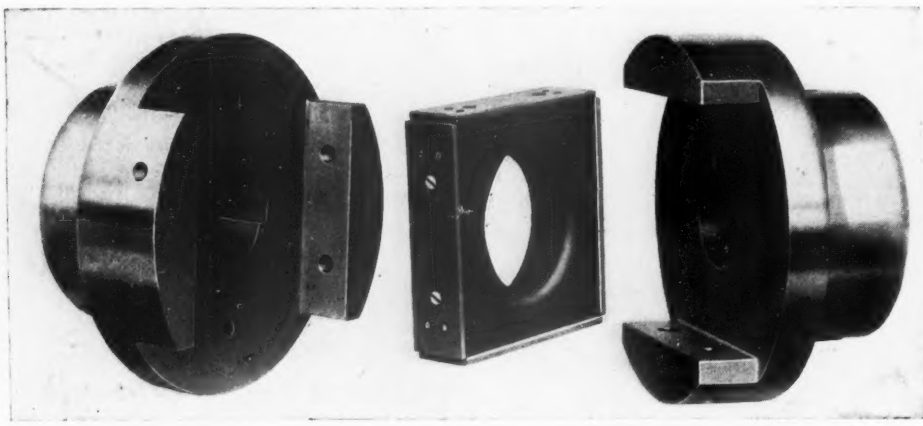
Concrete land-marker

The metal hooks set in on the sides are used to fasten wire fences as shown here. The beauty of these markers lies in their cheapness; they cost about $15 each; and once they are in, they need never be replaced except in unusual cases.

New Machinery and Equipment

New Flexible Coupling

THE American Flexible Coupling Co., Erie, Penn., is now marketing a novel design of shaft coupling, known as the "American" flexible coupling. Kinematically the device is a variation of the Oldham coupling in which a center member is constrained to slide across the face of one coupling flange on a line passing through the center and, at the same time, is free to slide across the face of the second flange in a direction at right angles to the first.



New flexible coupling in disassembled position to show construction

The floating center member of the new coupling is a square, hollow casting, with a hole in the center to provide clearance for the shaft ends. To the edges of this floating member are fastened replaceable bearing strips made from a hard, tough, nonmetallic compound, such as is used in the manufacture of nonmetallic pinions and gears.

The flange sections are identical and interchangeable, except for the bore diameters which are made to suit the shafts. The flange is cast in one piece with a hub of ample dimensions. A wide groove is machined in the face of the flange, leaving two jaws between which the floating member slides and by which the torque is transmitted.

The coupling can be removed without the use of special tools by simply pulling the jaw flanges apart horizontally or sliding them past each other vertically. The nonmetallic bearing strips can be replaced in a few minutes when necessary without disturbing the couplings or the connected shafts. The bearing strip screws are removed through holes in the jaws, when the old strips can be slipped out and new ones inserted.

The floating hollow center member is filled with grease which passes to the surfaces of the wearing strips through suitable channels furnished with wicks. In operation centrifugal force assists proper lubrication. By means of an ordinary grease gun the center member can be filled with fresh grease through any one of the bearing strip screw holes.

It is stated by the manufacturer that the coupling provides maximum flexibility without the use of flexible materials; that the device does not deteriorate rapidly when subjected to moisture, heat and dirt; that it is convenient and accessible for replacement or repairs with a resulting low cost for maintenance and lost production time.

New Safety Push Button

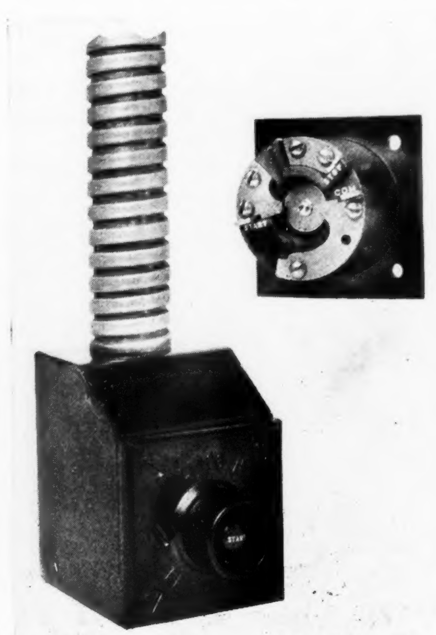
A NEW safety-type push button recently developed by the Lincoln Research Laboratories is now being marketed by the Lincoln Electric Co., Cleveland, Ohio. The design of this new safety push button is a departure from the usual type of push button switch design in that it offers unusual safety features. A ball-top "start" button is contained inside a large "stop" button which projects over the "start" button. Thus the large projecting "stop" button protects the "start" button from accidental contact. The "start" button can only be operated by the tip of a thumb or finger inserted inside the "stop" button. The "stop" button can be operated by a finger or the palm of the hand. The colors of push buttons are in accordance with the accepted standard traffic signal colors. The "start" button is of green molded Bakelite with the word "START" in white letters across the face of the button. The surrounding "stop" button is of red molded Bakelite.

The inner mechanism is enclosed in an arc-welded steel box 2½x3¼x2½-in. in size. All insulating parts are of molded Bakelite. The entire exterior of the unit is black with the exception of the push buttons.

Another distinguishing feature of the new safety-type push button is the ease of installation, according to the manufacturers. Four screws hold the molded black Bakelite face plate to the container. By removing these screws the entire operating mechanism may be removed from the case for wiring. As can be seen in the illustration, the binding posts are plainly indicated by white letters on the black Bakelite, thus preventing chance of error in making connections. In top of the steel case an opening ⅞-in. in diameter permits the entrance of conduit-enclosed wire to the button. For easy attachment there are two holes in the back of the case for bolts, rivets or screws.

New Welding Rod

THE Haynes Stellite Co., Kokomo, Ind., has placed on the market a manganese-chrome-iron welding rod called "Hascrome." This is a self-hardening alloy, designed primarily for building up badly worn parts preparatory to surfacing them with Haynes "Stellite," which is also supplied in the form of welding rod. Since the cost of Hascrome is materially less than that of Haynes Stellite, the resulting composite surface is much cheaper than if entirely built up of the latter alloy. Although in some cases Hascrome alone may be used for hard-surfacing parts subject to abrasive wear, it does not possess red hardness to the same degree as Haynes



Safety-type push button switch

Stellite, and it will wear away more rapidly. The new alloy is also being used for taking "Haystellite"—the Haynes Stellite Co.'s diamond substitute—to the cutting and reaming edges of oil well drilling tools.

The oxy-acetylene process is considered best for the application of Hascrome, since the hardness of the deposited metal can be controlled by the amount of excess acetylene used in the welding flame, as well as by the rate of cooling. The greater the excess of acetylene in the flame and the slower the cooling rate, the harder the deposit will be. When quenched, the metal becomes softer and tougher. Hascrome is applied to steel without puddling the steel. Best results are obtained when the deposit is made just so the steel surface is at a "sweating" heat.

The Hascrome deposit is claimed to have a tensile strength of 40,000- and a compressive strength of 177,000 lb./in.^{2}. It can be forged and ground, but not machined.

Hascrome welding rod can also be applied by means of the metallic arc process, by the use of reverse polarity, making the rod the positive electrode. Care must be taken to prevent cracking after quenching when this method is employed.

Hascrome is available in welding rods ¼-in. in diameter and 36-in. long, packed in bundles of 50 lb. each.

New Flood-Light Projectors

THE NEW LINE of floodlighting projectors which has been announced by the General Electric Co. should be of interest to rock products operators for use in night quarry or pit operation or general use about the plant.

The projectors have non-ferrous, and hence non-rusting casings; and the glass reflectors and lamps are totally enclosed so that dust and dirt cannot enter or impair efficiencies. Ease and accuracy in focusing are attained through the use of unique universal focusing mechanisms. A small three-point base design and swivel give simple and economical mounting, with ease of installation and orientation of the floodlight beam.

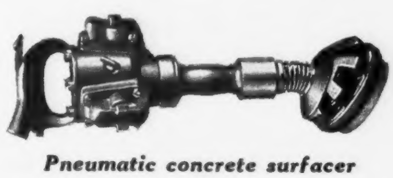
Two sizes of lenses are available, the clear lenses with plain, lightly stippled, heavily stippled and spreadlight distribution. The colored lenses are supplied with plain or heavily stippled distribution. All lenses are of heat-resisting glass. The reflectors are of silver-plated glass, protected by copper backing. Reflectors of the same size are interchangeable in any of the projectors.

The Type-L-29 projector, designed primarily for use with a 250-watt floodlighting lamp, is small in size and is particularly adapted for mounting in places where the available space is limited. It is suitable for working distances of from 85 to 200 feet.

The Type L-30 projector is designed primarily for use with a 500-watt floodlighting lamp and with any of three reflectors, with the various lenses available, affords desired distribution of light. The Type L-31 projector is designed primarily for use with a 1000-watt lamp.

Pneumatic Concrete Surfacer With Various Attachments

THE Chicago Pneumatic Tool Co., New York, N. Y., has recently brought out a new tool known as the No. 33 concrete surfacer. This surfacer is for finishing and smoothing concrete, eliminating form marks



Pneumatic concrete surfacer

and for similar work, including the polishing of stone. It should find a number of applications in cement products plants, particularly in those which manufacture special products, cast stone and trim stone. The company states that it is especially well adapted for rounding corners and edges, and for bringing the work to a highly polished surface.

The surfacer is supplied with a number of attachments, including a No. 20 grinding wheel, a cutting attachment, and a finer grinding wheel. The No. 20 wheel is for coarse grinding and comes with the wheel head complete. The cutting attachment is used for removing form marks on high spots from concrete that has taken a permanent set. It consists of a head with seven sets of steel burring wheels. The grinding wheel is used to smooth up or remove form marks from fresh or green concrete. It is also used to give a pebble finish. When a finer finish is desired, water is brushed on the surface before grinding. By using the grinding wheel after the cutting attachment, a finer finish is secured.

According to the announcement, the design of the surfacer permits a minimum weight with simplicity in construction. There are three major assemblies — the housing, cylinder, and live air grip handle. The unit has three cylinders, 120 deg. apart, each cylinder being provided with its own valve of the piston type, thus allowing extremely short live air ports. Pistons and toggles are of the pin type and the vent tube is of the centrifugal ball check type. When the machine is at rest the ball check is seated, preventing the loss of lubricant. Anyone of the three cylinders, pistons, rods or valves, may be disassembled without disturbing the other two assemblies. Removal of the grip handle and one cylinder permits the removal of the crank shaft.

Detachable Watthour Meter

DETACHABLE watthour meters for use either indoor or outdoor are now available from the Westinghouse Electric and Manufacturing Co., which has designed and put on the market this new device comprising the standard temperature-compensated OB watthour meter housed in a weatherproof case. The advantages claimed for the new meter are:

Plug terminals which make installation or removal easy; detachable meters can be

Detachable watthour meter

plugged into place or removed in a moment like radio tubes.

It is said to be suitable for mounting in any location, outdoor or indoor; to reduce labor, reading and testing costs. Completely iron-clad and tamper-proof.

An adjustable terminal block permits mounting the meter with conduit entrance at top, bottom, right or left.

This watthour meter can be mounted either indoor or outdoor and installed or removed quickly and easily, the manufacturers say.

New Hand Book on Material Handling Equipment

THE Robins Conveying Belt Co., New York, has published its latest catalog No. 75 for the users of belt conveyors and other material handling equipment. The catalog is a well bound volume of 300 pages, highly illustrative of the uses to which conveyors and other equipment have been put.

Any engineer contemplating a conveyor installation has in this volume all the engineering data necessary for him to design and select the proper mechanical equipment and belt for practically all conveyor needs as well as other engineering data indirectly related to material handling problems. Many tables of helpful data are included.

There are 14 sections in the catalog, each dealing with a separate subject. Belt conveyors, bucket elevators, storage and reclaiming, dragline scrapers, screens and skip hoists are some of the major subjects discussed in the new catalog.

News of All the Industry

Incorporations

Harleston and Womack, Kentwood, La., $25,000.

The Dicalite Co., Dover, Del., 10,000 shares common. To produce gypsum, lime and cement.

Ready-Mixed Concrete Co., Lawrence, Kan., $10,000.

Lake Ports Supply Co., Wilmington, Del., 20,000 shares, no par value. To deal in stone, gravel, cement, tile, etc.

Hawthorne Concrete Products Corp., New York City, 750 shares common. T. W. Hill, 551 E. 241st St., New York City.

Gaston Granite Co., Gastonia, N. C., $100,000. H. Rutter, H. L. Rutter and G. R. Dixon of Gastonia.

United Roof Cement Co., New York City, 200 shares common. M. Hoffman, 1475 Broadway, New York City.

Asbestos-Talc Products Co. of Washington, Inc., Mount Vernon, Wash., $23,000. C. R. Buck, Emanuel A. Alm, Harvey D. Williams and W. A. George.

Standard Cement Products Co., Palmyra, Penn., $25,000 (500 shares, par value $50 each). Harold U. Landis, Henry Bordlemay, Mark N. Rishe and Perry Bicksler.

Fort Worth Sand and Gravel Co., Inc., Fort Worth, Tex., converting capital stock from $200,000 to 20,000 common no par value shares and $1,000,000.

Conestoga Stone and Lime Co., 37 S. Queen St., Lancaster, Penn., $10,000. Harry C. Rote, John R. Bowermaster and George M. Tschudy, all of Lancaster.

Granite Sand and Gravel Co., Indianapolis, Ind., increasing capital stock to 3500 shares common, no par value, and 750 shares preferred, par value $100 each.

Vulcan Sand and Stone Co., Plainville, Conn., $30,000 (300 shares common stock of $100 par value). David F. and Mary E. Carton of Tuckahoe, N. Y., and Arthur J. and Theodore M. Martin of Plainville.

Sand and Gravel

J. W. Brannan Sand and Gravel Co., Denver, Colo., had $5000 damage when a fire broke out in its mortar plant on November 14.

Whitney Materials Co., Duluth, Minn., has established a new sales office on Superior St. at Fourth Ave. West, Duluth. F. G. Wood, sales manager, is in charge of the new office.

Pacific Rock Co., Centerville, Calif., is being reorganized and the name changed to Centerville Sand and Gravel Co. E. W. Burr is the new president and M. T. Scott is manager.

Salem, Ore. One of the three county gravel plants which has been crushing rock for the Mount Angel-Gervais road has been moved to the Silverton-Meridian road, where some 3000 yd. of material is needed for completing the road.

Nichols Sand and Gravel Co., Milwaukee, Wis., had a loss of $25,000 when its two-story garage and residence building at 211 W. Milwaukee Ave. was destroyed by fire. Five trucks, two small coupes, a tractor and other equipment of the company were destroyed.

Quarries

Ripley County Limestone Quarries, Osgood, Ind., resumed operations after four weeks' shutdown.

Ingleside, Colo. An extension of the Ingleside branch of the Colorado and Southern railroad is now being made to the new lime quarry in the Owl canyon region.

De Witt, Mo. It is reported that another quarry is to be opened in the bluff southwest of De Witt, the stone to be used in a river improvement project on the Carroll County side of the Missouri directly south of the proposed quarry.

Payne, Ohio. It is reported that a company, name unannounced, is making investigation with the purpose of opening up stone quarries on the Snellenberger farm and adjacent land, a few miles northeast of Payne.

G. C. Buquo, Hot Springs, N. C., has leased limestone deposits on the John Susong farm, four miles east of Newport, Tenn., and according to reports will install a rock crusher with a capacity of 2000 tons daily at an expenditure of $50,000.

Liberty Hill, S. C. The Natural Resources Commission of South Carolina has discovered a very large granite quarry here on the farm of Governor John G. Richards. It is possible that a large amount of the stone will be used for road work in the lower part of the state.

Spokane, Wash. City council has approved the purchase of 20 acres of land at the east city limits between Hartson and Tenth Sts., for $6000. A rock crusher will be installed and it is estimated the property will serve the city's rock needs for a period of 50 years.

Bluffton, Ohio. Resolution asking the National Lime and Stone Co. to reconsider its decision to close down its stone quarry here was passed by the town council. Following a fire which damaged holdings to an extent of some $300,000, the company decided not to rebuild the plant (see ROCK PRODUCTS, October 26).

Gypsum

United States Gypsum Co., Chicago, Ill., is to have a storage building, two stories high, to cost approximately $80,000, at 56th St. and Schuylkill, Philadelphia, Penn. Morton C. Tuttle Co., Boston, Mass., are the engineers.

National Gypsum Co., Buffalo, N. Y., is now producing a "super-fibered surface" wallboard which is described as like a wood veneer and offers an excellent base for decoration by paint or texture finish. The new surface is said to be firm and even and to require no sizing. It is identified by a special cream-tone color.

Cement

Signal Mountain Portland Cement Co., Chattanooga, Tenn., held its quarterly session of directors Friday, November 1.

Columbia Cement Co., San Diego, Calif., is now located in its new offices at 521 Union Bldg. The new company (see ROCK PRODUCTS, October 26), which is said to be a $2,000,000 concern, will construct a cement plant at National City, Calif.

National Portland Cement Co. has acquired quarries fronting 1750 ft. on the river front at Vicksburg, Miss., and proposes to erect a 3500-bbl. capacity cement mill (see ROCK PRODUCTS, October 26). A. J. Kutner, assistant general manager, Santa Fe Bldg., Dallas, Tex.

Cement Products

Milsap Concrete Plant, Rupert, Idaho, has been acquired by Wm. Clark, Jr., from W. J. Milsap. The company manufactures concrete headgates and pipe.

McLaughlin Concrete Products and Fuel Co., 624 Eastern Ave., South Beloit, Wis., has been sold to William Kepplinger and is now known as the Ideal Concrete Products and Fuel Co.

Angeles Gravel and Supply Co., Port Angeles, Wash., is supplying concrete for the new plant of the Olympic Forest Products Corp. from its new central mixing plant at Ennis Creek. The new plant has been producing approximately 40 yd. of concrete per hour since it started operating.

Ornamental Concrete Works, Vancouver, Wash., formerly located on Fourth St., has moved to larger quarters at 205 E. 15th St. of this city. The new location will save long hauling of the materials from the company's sand pit at 30th St. L. J. McGee is manager.

Texas Concrete Products Co., Inc., Houston, Tex., recently organized, has secured a site on McCall St. of this city, near the Missouri Pacific tracks, and will erect a large plant for the manufacture of cement products. The new company will specialize in the manufacture of concrete fence posts.

Agricultural Limestone

Vermillion County, Ind. What is said to be the largest special agricultural limestone train ever run in Indiana was operated in this county recently. Twenty cars, containing 950 tons of limestone for fertilizer, were unloaded along the C. & E. I. right-of-way and crossings to facilitate transportation to farmers.

Washington County, Tenn. A shipment of 30 cars of agricultural limestone was recently ordered by 192 farmers of this county. Since August, 1927, Washington county farmers have used 3500 tons of limestone, of which 1000 tons have been crushed on the farms, according to County Agent Raymon Rosson, who believes that 3000 tons will be used in 1930.

Miscellaneous Rock Products

Asbestos-Talc Products Co., Mount Vernon, Wash., incorporation notice of which appears in this issue, has been organized by a group of Skagit county residents to develop asbestos deposits recently discovered in this county.

Nantahala Co., recently formed, has acquired the property of the North Carolina Talc and Mining Co., Hewitts, N. C., comprising 8000 acres in the Nantahala Gorge, about 125 miles east of Andrews, N. C., and plan developing marble, limestone and soapstone deposits and talc mine.

Obituaries

Frederick Wagner Stark, a director of the Hercules Powder Co., Wilmington, Del., passed away October 28 following several months' illness.

H. A. Coles, Atlanta district manager of the Westinghouse Electric and Manufacturing Co., died recently in New Orleans, La., of heart failure.

Andrew Gregg Watson, president of the Butler Products Co., manufacturers of concrete block, Joliet, Ill., died November 14 after a long illness.

George Lynch, 47 years old, Evansville, Ind., employed on a steamer of the Koch Sand and Gravel Co. of that city, was instantly killed at dam 46 on the Ohio river near Owensboro, Ky., on November 14 when the engine on the boat exploded. Mr. Lynch was sleeping on a cot on the deck above the engine when the explosion occurred.

Personals

Bert Koenig, secretary of the Koch Sand and Gravel Co., Evansville, Ind., has been elected vice-president of the Evansville Kiwanis Club.

W. C. Sutherland was elected a director of the Pittsburgh Steel Co., Pittsburgh, Penn., to fill the vacancy caused by the death of E. H. Finley.

Lloyd R. Wilson, formerly with the Lakewood Engineering Co., Cleveland, Ohio, is now associated with the C. O. Bartlett & Snow Co., Cleveland, as manager of sales of Bartlett-Snow truck bodies for transporting ready-mixed concrete.

M. O. Matthews, manager of the Oklahoma Portland Cement Co., Ada, Okla., was elected vice-president of the National Association of Manufacturers at its annual meeting held in New York City recently.

W. R. Wood, senior vice-president of International Combustion Engineering Corp., New York City, has been placed in control of the affairs of the company, due to the illness of George E. Learnard, president.

Arthur C. Allshul, formerly manager of the Buffalo plant of Joseph T. Ryerson & Son, Inc., Chicago, has been appointed manager of the company's new unit in the Philadelphia district. **Clarence S. Gedney** has been appointed manager of the Buffalo plant, succeeding Mr. Allshul.

Edward W. Russell, for the past three years assistant sales manager of the National Cement Co., Birmingham, Ala., has resigned his position here. Mr. Russell has been connected with the southern cement industry for ten years, and before his connection with the National Cement Co. was district manager in Florida for the Atlas Portland Cement Co. for six years.

Thomas Fuller, formerly manager of the Charlotte, N. C., office of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has been appointed manager of the Atlanta district office to fill the vacancy caused by the death of H. A. Coles. Mr. Fuller has been prominently identified with many of the big electrical projects

ONE 7-inch Newhouse crusher, operating in closed circuit with a scalping screen, is handling the oversize from this pit. The material from the 24-inch belt conveyor, operating at approximately 280 feet per minute, is screened, the minus 2-inch ring size is bypassed and the oversize goes to the crusher. Much of the oversize consists of granite boulders, many of them having a one way dimension little less than the width of the crusher receiving opening. Notwithstanding this large feed, the crusher operates without bridging. This is due to the crusher's short rapid crushing stroke which also gives large unit capacity.

The few working parts, absence of gears and general simplicity of the Style "B" Newhouse crusher makes it a very economical machine to operate. Suspending the crusher by cables from the framework of the building eliminates expensive foundations and reduces installation costs. Built with receiving openings of 7, 10 and 14 inches.

Bulletin 1469 describes this *crusher that needs no foundations.*

ALLIS-CHALMERS

Milwaukee, Wisconsin

of the South and is well known in the electrical industry.

J. J. Kelleher has become associated with the contractors' division, Explosives Department of the Hercules Powder Co., Wilmington, Del. **J. R. St. Clair**, formerly of the sales force of the company's Duluth, Minn., branch, has been transferred to the explosives technical service staff at the home office.

Capt. James G. Ross has been appointed mines manager at Thetford of the Asbestos Corp., Ltd. Capt. Ross has had wide experience in asbestos mining and milling, and recently completed a monograph on asbestos for the Dominion Government Mines Branch.

Manufacturers

Prest-O-Lite Co., Inc., New York City, is to construct an acetylene plant at Casper, Wyo.

G. H. Williams Co., Erie, Penn., has moved its Chicago branch office to large quarters at 614 Peoples Gas Bldg. C. F. Weiblen is in charge.

American Locomotive Co., New York City, has purchased the control of MacIntosh and Seymour, Diesel engine manufacturers.

Pittsburgh Steel Co., Pittsburgh, Penn., at its recent board of directors' meeting, elected W. C. Sutherland a director.

The Dodge Manufacturing Corp., Mishawaka, Ind., announce the appointment of E. S. Grant, formerly assistant general sales manager in charge of the Eastern district, as general sales manager.

Chicago Pneumatic Tool Co., New York City, is planning further extension of its plant at Franklin, Penn., which was recently enlarged at an expense of $750,000.

American Cable Co.'s Chicago headquarters, handling sales and service on Tru-Lay wire rope and Tru-Lac fittings, has been moved from 160 N. LaSalle St. to Room 1765, 400 West Madison St., Chicago.

Morrison Railway Supply Corp. announces the removal of its administrative and general sales offices from its Buffalo plant at 1438 Bailey Ave. to the Morrison Bldg., 25 East Huron St., Buffalo, N. Y.

Flexible Steel Lacing Co.'s Flexco H. D. belt fasteners are used throughout the Penfield (N. Y.) plant of the Dolomite Products Co., described in "Rock Products" September 28. Through an oversight mention of this was not included in the article.

Geo. D. Whitcomb Co., Rochelle, Ill., has under construction a new factory unit, to be used primarily for the erection of large oil-electric locomotives from 20 to 100 tons. Two cranes, one of them of 50-ton capacity, will serve this new erection bay and facilitate handling of large units.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., recently received an order from the Philadelphia and Reading Coal and Iron Co. for three 30-ton locomotives to be used in connection with the new Locust Summit central breaker.

Young Radiator Co., Racine, Wis., announces the issuing of its second group of insurance policies to some 158 employes through co-operation with the Metropolitan Life Insurance Co. The plan was inaugurated by the officials of the company for the benefit of both its factory and office workers.

Wagner Electric Corp., St. Louis, Mo., announce that D. O. Reardon is now representing the company in Iowa, with headquarters at Des Moines. For the past seven years Mr. Reardon has been Iowa representative for the merchandising division of the Westinghouse Electric and Manufacturing Co.

Sullivan Machinery Co., Chicago, Ill., has recently completed the construction of an addition to its Michigan City, Ind., plant. Machine tool equipment at both the Claremont, N. H., and Michigan City, Ind., plants has been increased during the year, and orders are now placed for additional tools.

Joseph T. Ryerson and Son, Inc., Chicago, Ill., has purchased the business, equipment and stock of the Penn-Jersey Steel Co., Camden, N. J., which carries a complete line of steel shapes, plates, sheets, hot and cold finished bars, reinforcing bars, etc. The Ryerson company plan to add to the stock and increase the facilities of the company.

General Electric Co., Schenectady, N. Y., recently granted awards aggregating $2035 to 150 employes of its Schenectady works for suggestions aiming at improving its mechanical and general office methods. Improvements suggested included a new method for removing and replacing inserts in gages and an improvement to a tape-winding machine.

General Refractories Co., Philadelphia, Penn., has appointed the Harris Pump and Supply Co., 319-21 First Ave., Pittsburgh, Penn., as dealer representatives for its Grefco Chrome High Temperature Cement and Standard Silica Bonding Cement in the Pittsburgh district. The territory covered will be the western half of Pennsylvania, as far east as Williamsport; also the northern part of West Virginia, the eastern part of Ohio, and the western end of Maryland.

The Fate-Root-Heath Co. (Plymouth Locomotive Works), Plymouth, Ohio, has just completed a large new factory unit. New equipment being installed will double the present output of the company's gear-drive gasoline and Diesel locomotives.

Ingersoll-Rand Co., New York City, has received an order from the Ford Motor Co. of Dearborn, Mich., for one 600-hp. and one 300-hp. oil-electric locomotive. These locomotives will be furnished with General Electric equipment.

Stanley Electric Tool Co., subsidiary of the Stanley Works, New Britain, Conn., has purchased the trade name, stock on hand, tools, fixtures and business of the Ajax Hammer Corp., 117 W. 63rd St., New York City, and will continue manufacture and development of the company's line of electric hammers for construction and maintenance work at its main plant at New Britain. Distribution will continue through regular established jobbing channels.

The Chain Belt Co., Milwaukee, Wis., announces the distribution of its "Rex" chains and transmission equipment through five new distributors in the Southeast—Bailey-Lebby Co. of Charleston, S. C.; the Georgia Supply Co. of Savannah, Ga., and Jacksonville, Fla.; Harry P. Leu Co. of Orlando, Fla., and the J. M. Tull Rubber and Supply Co. of Atlanta, Ga. The company has also opened a New England district office in Boston at 950 Park Square Bldg. J. K. Merwin is district manager.

McKiernan-Terry Drill Co., New York City, has changed its corporate name to McKiernan-Terry Corp. and acquired ownership of the National Hoisting Engine Co., Harrison, N. J., and Steele and Condict, Inc., Jersey City, N. J. The two last mentioned companies will preserve their identity to the extent that they will operate as divisions of the McKiernan-Terry Corp., but with executive activities transferred to the sales offices of the corporation in New York. For economic reasons work previously done at the Jersey City plant of Steele and Condict will be transferred to and divided between the McKiernan-Terry plant at Dover, N. J., and the National Hoisting Engine plant at Harrison, N. J., both plants having been substantially enlarged for the purpose. Arthur W. Buttenheim is president, Samuel S. Whitehurst, secretary, and Thomas E. Sturtevant, treasurer.

Trade Literature

Shovels. Folder telling of the plant, organization and policies of the MARION STEAM SHOVEL CO., Marion, Ohio.

Lift Trucks. Circular **No. 100** covering "The Footlift" lift-truck for loads up to 3500 lb. LEWIS-SHEPARD CO., Boston, Mass.

Shovels. Broadside covering Lorain ¾-yd., 1-yd. and 1¼-yd. shovels, with center drive. THE THEW SHOVEL CO., Lorain, Ohio.

Sand-lime Brick. Circular showing examples of construction with sand-lime brick. THE JACKSON BRICK CO., Jackson, Mich.

Sand Lime Brick. Folder describing "Rock-O-Lite" sand lime brick, its content, strength and uses to which it is adapted. SAND LIME PRODUCTS CO., Detroit, Mich.

Roof Plank. Bulletin **No. 19-A-31** on Awlco-ized roof plank—lumber specially treated to withstand decay. PROCESSED LUMBER CO., Elizabeth, N. J.

Lignite. Reprint of article, "Operating Experience Proves Pulverized Lignite a Satisfactory Fuel," by V. H. Braunig. COMBUSTION ENGINEERING CORP., New York City.

Water Wheels. Bulletin **W-205** on Leffel water wheel installation. Bulletin **W-206** covering Leffel turbines from 5 hp. to 10,000 hp. JAMES LEFFEL AND CO., Springfield, Ohio.

Tractors. "The Romance of Caterpillar Tractors" is the title of a 32-page booklet telling of the many uses to which tractors may be adapted. CATERPILLAR TRACTOR CO., San Leandro, Calif.

Gyratory Crushers. Bulletin **No. 2100** describing in detail Bulldog gyratory crusher and Bulldog finishing gyratory crusher. TRAYLOR ENGINEERING AND MANUFACTURING CO., Allentown, Penn.

Anti-Slip Treads. Bulletin on Feralun Anti-Slip Treads for power plants and industrial plants. Prevent accidents due to slipping and falling. AMERICAN ABRASIVE METALS CO., New York City, N. Y.

Screens and Screening Equipment. Folder on the importance of screening to crushing and grinding, and describing and illustrating Hum-mer Screens. THE W. S. TYLER CO., Cleveland, Ohio.

Rubber Goods for Mining Industry. Circular on conveyor and elevator belting, water hose, steam hose, acetylene welding hose, sheet packing, piston packing and pump valves. NEW YORK BELTING AND PACKING CO., New York City.

Kiln-Mill. Bulletin dealing with the performance records of the Raymond Kiln-Mill, an air-drying pulverizer which dries and grinds the material in one operation. RAYMOND BROS. IMPACT PULVERIZER CO., Chicago, Ill.

Pulverizers. Bulletin on Pulverizers for reducing limestone to agricultural sizes, or for making coarser materials for road surfacing, pebble dash, etc. UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa.

Sand Blasts and Dust Collectors. Folder outlining uses and completely describing Pangborn sand blasts and dust collectors, issued in celebration of silver anniversary of their manufacture. PANGBORN CORP., Hagerstown, Md.

Building Products. Removable and permanent steel tile, stucco reinforcement, Kalmanlath strips, hanger inserts, and 60 other products in the Kalman line are covered in a circular captioned "Team Work." KALMAN STEEL CO., Chicago, Ill.

Explosives. "The Labors of a Modern Hercules" is the title of an interesting brochure containing a series of articles by chemists and engineers descriptive of Hercules processes and products, and how they serve industry. HERCULES POWDER CO., Wilmington, Del.

Slurry and Sludge Pumps. Bulletin **No. 135** illustrating and describing slurry and sludge pumps for transferring slurry in cement mills, and other liquids or mixtures containing fine sand or other highly abrasive solids. MORRIS MACHINE WORKS, Baldwinsville, N. Y.

Sand and Gravel Washing Plants. Eighty-page book, **No. 640**, on plants for washing sand and gravel, completely describing and illustrating all equipment for plants of this character, with dimensions and other helpful specifications. LINK-BELT CO., Chicago, Ill.

Admixture for Concrete. Booklet outlining advantages of Diatite, a light-weight, dry powder composed of minute particles of diatomaceous silica, successfully used as an admixture for concrete. B. C. REFRACTORIES, LTD., Vancouver, Canada.

Elutriation. Booklet outlining general principles of Kinetic elutriation, the hydraulic classification of solids at high velocity, and describing in detail construction features of Kinetic elutriators. KINETIC ELUTRIATORS, LTD., London, W. C. 1, England.

Arc Welders of Various Types. Bulletins **S-1931A** and **S-1935A** on "Stable-Arc" welder of stationary platform type; **S-1932A** and **S-1936A** on portable truck type; **S-1459A**, belt driven type; **S-1964A**, gasoline engine driven type. All 300 ampere. LINCOLN ELECTRIC CO., Cleveland, Ohio.

Flexible Couplings. Bulletin **No. 101**, attractively illustrated and comprehensively outlining principle and design of American flexible couplings. With table of dimensions and other details. THE AMERICAN FLEXIBLE COUPLING CO., Erie, Penn.

Heating Units and Forced Draft Fans. Bulletin **No. 7818** on Venturafin method of heating for floor, wall or ceiling mounting; high, medium or low pressure steam applications. Bulletin **No. 10401** on Sirocco forced draft fans for domestic heating plants. Completely illustrated with dimension diagrams and capacity tables. AMERICAN BLOWER CORP., Detroit, Mich.

Track Machine and Power Jack. Bulletin on gasoline engine driven Power Jack for ballasting work, with lifting capacity of 30,000 lb. Also bulletin on Model "S" track machine for heavy ballasting, raising grade, building fills and elevation work, with leveling device for track raising work. NORDBERG MANUFACTURING CO., Milwaukee, Wis.

Oil Purifiers, Arc Welding, Turbine Generator Sets. Bulletin **No. 20240C** discusses Sharples super centrifuge oil purifiers. Bulletin **No. 20418** describes 300-ampere, gas engine driven, arc welding set and explains construction of stationary and portable units. Bulletin **No. 20378** deals with the general features and construction of the new 25- to 50-kw. d-c. geared turbine generator sets. WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., East Pittsburgh, Penn.

G-E Bulletins. GEA-556C, covering Type MC automatic arc welding head with control equipment, consisting of CR4909 control panel, a meter panel and a push-button station. **GEA-569C** on constant potential arc-welding sets, especially suitable for furnishing power to a number of welding stations and for operating automatic welding equipment, in sizes from 400 to 1500 amperes. **GEA-834A** on CR7764-C1 and CR7765-B1 controllers for use with wound-rotor, induction motors driving ventilating fans, blowers, or other machines where the torque required decreases as the speed is reducd. **GEA-948A** on CR4065 DC. magnetic controllers for constant speed motors, designed for wall or floor mounting, either open or enclosed. **GEA-1162** on CR2922-B1 pressure governor recommended for use with automatic starters for alternating-current and direct-current motor-driven pumps or compressors to maintain a constant pressure between set limits on liquid or gas systems. GENERAL ELECTRIC CO., Schenectady, N. Y.